An Oshkosh Corporation Company

Service & Maintenance Manual

Model
80SL

3121325

March 24, 2011

ANSI

An Oshkosh Corporation Company

SECTION A. INTRODUCTION - MAINTENANCE SAFETY PRECAUTIONS

A. GENERAL

This section contains the general safety precautions which must be observed during maintenance of the aerial platform. It is of utmost importance that maintenance personnel pay strict attention to these warnings and precautions to avoid possible injury to themselves or others, or damage to the equipment. A maintenance program must be followed to ensure that the machine is safe to operate.

⚠ WARNING

MODIFICATION OF THE MACHINE WITHOUT CERTIFICATION BY A RESPONSIBLE AUTHORITY THAT THE MACHINE IS AT LEAST AS SAFE AS ORIGINALLY MANUFACTURED, IS A SAFETY VIOLATION.

The specific precautions to be observed during maintenance are inserted at the appropriate point in the manual. These precautions are, for the most part, those that apply when servicing hydraulic and larger machine component parts.

Your safety, and that of others, is the first consideration when engaging in the maintenance of equipment. Always be conscious of weight. Never attempt to move heavy parts without the aid of a mechanical device. Do not allow heavy objects to rest in an unstable position. When raising a portion of the equipment, ensure that adequate support is provided.

⚠ WARNING

SINCE THE MACHINE MANUFACTURER HAS NO DIRECT CONTROL OVER THE FIELD INSPECTION AND MAINTENANCE, SAFETY IN THIS AREA RESPONSIBILITY OF THE OWNER/OPERATOR.

B. HYDRAULIC SYSTEM SAFETY

It should be noted that the machines hydraulic systems operate at extremely high potentially dangerous pressures. Every effort should be made to relieve any system pressure prior to disconnecting or removing any portion of the system.

Relieve system pressure by cycling the applicable control several times with the engine stopped and ignition on, to direct any line pressure back into the reservoir. Pressure feed lines to system components can then be disconnected with minimal fluid loss.

C. MAINTENANCE

⚠ WARNING

FAILURE TO COMPLY WITH SAFETY PRECAUTIONS LISTED IN THIS SECTION MAY RESULT IN MACHINE DAMAGE, PERSONNEL INJURY OR DEATH AND IS A SAFETY VIOLATION.

- NO SMOKING IS MANDATORY. NEVER REFUEL DURING ELECTRICAL STORMS. ENSURE THAT FUEL CAP IS CLOSED AND SECURE AT ALL OTHER TIMES.
- REMOVE ALL RINGS, WATCHES AND JEWELRY WHEN PERFORMING ANY MAINTENANCE.
- DO NOT WEAR LONG HAIR UNRESTRAINED, OR LOOSE-FITTING CLOTHING AND NECKTIES WHICH ARE APT TO BECOME CAUGHT ON OR ENTANGLED IN EQUIPMENT.
- OBSERVE AND OBEY ALL WARNINGS AND CAUTIONS ON MACHINE AND IN SERVICE MANUAL.
- KEEP OIL, GREASE, WATER, ETC. WIPED FROM STANDING SURFACES AND HAND HOLDS.
- USE CAUTION WHEN CHECKING A HOT, PRESSURIZED COOLANT SYSTEM.
- NEVER WORK UNDER AN ELEVATED SIZZOR UNTIL PLATFORM HAS BEEN SAFELY RESTRAINED FROM ANY MOVEMENT BY BLOCKING OR OVERHEAD SLING, OR SAFETY PROP HAS BEEN ENGAGED.
- BEFORE MAKING ADJUSTMENTS, LUBRICATING OR PERFORMING ANY OTHER MAINTENANCE, SHUT OFF ALL POWER CONTROLS.
- BATTERY SHOULD ALWAYS BE DISCONNECTED DURING REPLACEMENT OF ELECTRICAL COMPONENTS.
- KEEP ALL SUPPORT EQUIPMENT AND ATTACHMENTS STOWED IN THEIR PROPER PLACE.
- USE ONLY APPROVED, NONFLAMMABLE CLEANING SOLVENTS.

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TABLE OF CONTENTS

SUBJECT - SECTION, PARAGRAPH **PAGE NO.**

SECTION A - INTRODUCTION - MAINTENANCE SAFETY PRECAUTIONS

A General 1-a
B Hydraulic System Safety 1-a
C Maintenance 1-a

SECTION 1 - SPECIFICATIONS

1.1 Operating Specifications 1-1
1.2 Dimensional Data 1-1
1.3 Capacities 1-1
1.4 Engine 1-2
1.5 Tires 1-2
1.6 Torque Requirements 1-2
1.7 Sensors 1-2
Platform Stowed/Jacks Retract Limit Switch 1-2
High Drive Speed Cutout Limit Switch 1-2
Maximum Drive Height/Maximum Height without Outriggers Limit Switch 1-2
Maximum Height Limit Switch 1-2
Tilt Sensor 1-2
Outrigger Sensors 1-2
Oscillating Axle Limit Switch 1-2
1.8 Pressure Setting 1-4
1.9 Major Component Weights 1-4
1.10 Critical Stability Weights 1-4
1.11 Lubrication 1-4

SECTION 2 - GENERAL

2.1 Machine Preparation, Inspection, and Maintenance 2-1
General 2-1
Preparation, Inspection, and Maintenance 2-1
Pre-Start Inspection 2-1
Pre-Delivery Inspection and Frequent Inspection 2-1
Annual Machine Inspection 2-1
Preventative Maintenance 2-1
2.2 Service and Guidelines 2-2
General 2-2
Safety and Workmanship 2-2
Cleanliness 2-2
Components Removal and Installation 2-2
Component Disassembly and Reassembly 2-3
Pressure-Fit Parts 2-3
Bearings 2-3
Gaskets 2-3
Bolt Usage and Torque Application 2-3
Hydraulic Lines and Electrical Wiring 2-3
Hydraulic System 2-3
Lubrication 2-3
Battery 2-3
Lubrication and Servicing 2-3
2.3 Lubrication and Information 2-4
Hydraulic System 2-4
Hydraulic Oil 2-4
Changing Hydraulic Oil 2-4
Lubrication Specifications 2-4
2.4 Operator Maintenance 2-5

2.5 Cylinder Drift Test 2-10
Platform Drift 2-10
2.6 Preventive Maintenance and Inspection Schedule 2-10

SECTION 3 - CHASSIS, PLATFORM & SCISSOR ARMS

3.1 Operating Characteristics 3-1
Leveling Jacks 3-1
3.2 Wheel Assembly 3-1
Drive System 3-1
Drive Hub 3-2
Roll Test 3-2
Leak Test 3-2
Lubricant 3-2
Tire Replacement 3-3
Wheel Replacement 3-3
Wheel Installation 3-3
3.3 Drive Motor 3-7
Motor Disassembly 3-8
Motor Assembly 3-8
3.4 Steering Assembly 3-9
3.5 Rear Axle 3-10
Limit Switches 3-10
3.6 Outrigger Cylinder Removal 3-11
3.7 Engine Compartment 3-13
Hood Assembly 3-13
Deutz Engine 3-14
Engine Tray Slide 3-15
Glow Plugs 3-16
Engine Solenoid Fuse 3-16
Hydraulic Pump Assembly 3-17
Hydraulic Pump 3-18
Exhaust Pipe Assembly 3-19
Air Filter Assembly 3-20
Engine Removal 3-21
Hydraulic Tank 3-22
Pressure Filter 3-23
3.8 Fuel Tank 3-24
3.9 Ground Control Panel 3-25
3.10 Battery Removal 3-26
3.11 Platform 3-27
Platform Control Box 3-27
Joystick Controller 3-28
Receptacles 3-29
Main Platform Side Rails 3-30
Main Platform End Rails 3-31
Platform Extension Side Rails 3-32
Platform Extension End Rail 3-33
Platform Removal 3-34
3.12 Ladder Installation 3-36
3.13 Beacon Installation (Option) 3-37
3.14 Scissor Arms 3-38
Limit Switches 3-38
Scissor Arm Assembly Removal 3-39
Lift Cylinder Removal 3-42
Scissor Arms Disassembly 3-43

SECTION 4 - HYDRAULICS

4.1 Cylinders - Theory of Operation 4-1

Deck Extension Cylinder: 4-1
Lift Cylinder: 4-1
Outrigger Cylinders: 4-1
Steer Cylinder: 4-1
4.2 Valves - Theory of Operation 4-1
Solenoid Control Valves (Bang-Bang) 4-1
Relief Valves 4-1
Crossover Relief Valves 4-1
Proportional Valve 4-1
4.3 Cylinder Checking Procedure 4-2
4.4 Cylinder Repair 4-2
Disassembly 4-2
Cleaning and Inspection 4-6
Assembly 4-7
4.5 Valves 4-17
Valve Compartment 4-17
Pressure Switch, Drive Enable 4-17
Brake Valve 4-18
Drive Valve 4-19
Main Valve Block 4-20
Pump Engage/Disengage Valve 4-21
Hand Pump 4-22
Load Holding Valve 4-23
Lift/Lower Valve Block 4-24
Platform Lower Flow Valve 4-24
Outrigger Safety Valves 4-25

SECTION 5 - JLG CONTROL SYSTEM

5.1 Main Terminal Box Circuit Boards 5-1
5.2 Control Card Complex 2 5-2
General Description of Components and Functions 5-2
5.3 Nivolux - Automatic Self-Leveling System 5-5
Introduction 5-5
The System 5-5
Operation 5-5
NIVOLUX Board LED's 5-6
Setting and Adjustment of the NIVOLUX Board 5-6
5.4 PNP5 Circuit Board 5-8
System 5-8
Operation 5-8
Adjustment 5-8
5.5 Trigger Control Circuit Card 5-8
Relay K1 5-8
Relay K2 5-8
Relay K3 5-9
5.6 Limit Switch & Sensor Operation 5-9
Height Limit Switches 5-9
Tilt Switch 5-10
Oscillating Axle Limit Switches 5-10
Outrigger Limit Switches 5-10
Pressure Switch 5-10
5.7 Engine Control System 5-11
Functional Description 5-11

SECTION 6 - GENERAL ELECTRICAL INFORMATION & SCHEMATICS

6.1 General 6-1
6.2 Multimeter Basics 6-1
Grounding 6-1

Backprobing 6-1
Min/Max 6-1
Polarity 6-1
Scale 6-1
Continuity Measurement Over Long Distances 6-4
Requirements: 6-4
Procedure 6-4
6.3 Applying Silicone Dielectric Compound To Amp Connectors 6-5
Assembly 6-6
Disassembly. 6-8
Wedge Lock. 6-8
Service - Voltage Reading 6-9
6.4 Working With Deutsch Connectors. 6-10
DT/DTP Series Assembly. 6-10
DT/DTP Series Disassembly 6-10
HD30/HDP20 Series Assembly 6-10
HD30/HDP20 Series Disassembly. 6-11

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE NO.
1-1.	Limit Switch Locations	1-3
1-2.	Engine Operating Temperature Specifications	1-5
1-3.	Torque Chart (Metric Conversion) - (For ASTM Fasteners)	1-6
1-4.	Torque Chart - (In/Lb - Ft/Lb). (For ASTM Fasteners)	1-7
1-5.	Torque Chart - (Nm) - (For Metric Class Fasteners)	1-8
2-1.	Lubrication Diagram	2-5
3-1.	Torque Hub	3-2
3-2.	Wheel Assembly Removal	3-4
3-3.	Hub Torque Values	3-5
3-4.	Torque Hub Assembly	3-6
3-5.	Drive Motor (OMR 100)	3-7
3-6.	Steering Assembly	3-9
3-7.	Oscillating Axle Limit Switches	3-10
3-8.	Outrigger Cylinder Removal - (Sheet 1 of 2)	3-11
3-9.	Outrigger Cylinder Removal - (Sheet 2 of 2)	3-12
3-10.	Hood Assembly	3-13
3-11.	Deutz F4L 2011	3-14
3-12.	Engine Tray Slide	3-15
3-13.	Glow Plugs	3-16
3-14.	Engine Solenoid	3-16
3-15.	Hydraulic Pump Assembly	3-17
3-16.	Variable Displacement Axial Piston Pump	3-18
3-17.	Exhaust Pipe Assembly	3-19
3-18.	Air Filter Assembly	3-20
3-19.	Engine Removal	3-21
3-20.	Hydraulic Tank Removal	3-22
3-21.	Pressure Filter Removal	3-23
3-22.	Fuel Tank Removal	3-24
3-23.	Ground Control Panel Removal	3-25
3-24.	Battery Removal	3-26
3-25.	Platform Control Box	3-27
3-26.	Joystick	3-28
3-27.	Platform Receptacle Box Removal	3-29
3-28.	Side Rails Removal	3-30
3-29.	End Rail Removal	3-31
3-30.	Extension Side Rails Removal	3-32
3-31.	Extension End Rail Removal	3-33
3-32.	Platform Removal - 1 of 2 (Front of Platform)	3-34
3-33.	Platform Removal - 2 of 2 (Rear of Platform)	3-35
3-34.	Ladder Installation	3-36
3-35.	Beacon Installation	3-37
3-36.	Limit Switch Adjustment	3-38
3-37.	Lift Cylinder Removal	3-42
3-38.	Scissor Arm Removal (Left Side)	3-43
3-39.	Scissor Arm Removal (Right Side)	3-43
4-1.	Lift Cylinder Valve Block Removal	4-2
4-2.	Load Check Valve Romoval	4-3
4-3.	Safety Valve and Limit Switch Removal	4-3
4-4.	Cylinder Barrel Support	4-3
4-5.	Cylinder Head Removal	4-4
4-6.	Cylinder Rod Support	4-4
4-7.	Piston Setscrew Removal	4-4
4-8.	Piston Removal	4-4
4-9.	Piston Seals	4-5

4-10. Spacer Removal 4-5
4-11. Cylinder Head Removal 4-5
4-12. Cylinder Head Seals 4-5
4-13. Bushing Installation 4-6
4-14. Rod Seal Installation 4-7
4-15. Cylinder Head Seal Installation 4-7
4-16. Cylinder Head Installation 4-7
4-17. Spacer Installation 4-8
4-18. Piston Seal Installation 4-8
4-19. Piston Installation 4-8
4-20. Piston Setscrew Installation 4-8
4-21. Rod Installation 4-9
4-22. Rod Assembly Installation 4-9
4-23. Valve Block Installation 4-9
4-24. Load Check Valve Installation 4-10
4-25. Safety Valve and Limit Switch Installation 4-10
4-26. Lifting Cylinder Assembly 4-11
4-27. Steering Cylinder Assembly 4-12
4-28. Outrigger Cylinder Assembly 4-13
4-29. Axle Locking Cylinder Assembly 4-14
4-30. Extension Cylinder Assembly 4-15
4-31. Arms and Platform Positioning and Support 4-16
4-32. Valve/Hydraulic Compartment 4-17
4-33. Pressure Switch Adjustment 4-17
4-34. Brake Valve 4-18
4-35. Brake Valve Adjustment 4-18
4-36. Drive Valve 4-19
4-37. Main Valve Block 4-20
4-38. Pressure Test Port 4-21
4-39. Proportional Valve Pressure Adjustment 4-21
4-40. Pump Engage/Disengage Valve 4-21
4-41. Hand Pump Assembly 4-22
4-42. Hand Pump Valve Schematic 4-23
4-43. Load Holding Valve 4-23
4-44. Lift/Lower Valve Block 4-24
4-45. Platform Lower Flow Valve 4-24
4-46. Outrigger Valves 4-25
5-1. Main Terminal Box 5-1
5-2. Control Card Complex 2 Board 5-2
5-3. Nivolux Control Board 5-5
6-1. Voltage Measurement (DC) 6-2
6-2. Resistance Measurement 6-2
6-3. Continuity Measurement 6-3
6-4. Current Measurement (DC) 6-3
6-5. AMP Connector 6-5
6-6. Connector Assembly (1 of 4) 6-6
6-7. Connector Assembly (2 of 4) 6-6
6-8. Connector Assembly (3 of 4) 6-7
6-9. Connector Assembly (4 of 4) 6-7
6-10. Connector Disassembly 6-8
6-11. Connector Installation 6-9
6-12. DT/DTP Contact Installation 6-10
6-13. DT/DTP Contact Removal 6-10
6-14. HD/HDP Contact Installation 6-10
6-15. HD/HDP Locking Contacts Into Position 6-11
6-16. HD/HDP Contact Removal 6-11
6-17. HD/HDP Unlocking Contacts 6-11
6-18. Electrical Schematic - Sheet 1 of 15 6-12

6-19. Electrical Schematic - Sheet 2 of 15 6-13
6-20. Electrical Schematic - Sheet 3 of 15 6-14
6-21. Electrical Schematic - Sheet 4 of 15 6-15
6-22. Electrical Schematic - Sheet 5 of 15 6-16
6-23. Electrical Schematic - Sheet 6 of 15 6-17
6-24. Electrical Schematic - Sheet 7 of 15 6-18
6-25. Electrical Schematic - Sheet 8 of 15 6-19
6-26. Electrical Schematic - Sheet 9 of 15 6-20
6-27. Electrical Schematic - Sheet 10 of 15 6-21
6-28. Electrical Schematic - Sheet 11 of 15 6-22
6-29. Electrical Schematic - Sheet 12 of 15 6-23
6-30. Electrical Schematic - Sheet 13 of 15 6-24
6-31. Electrical Schematic - Sheet 14 of 15 6-25
6-32. Electrical Schematic - Sheet 15 of 15 6-26
6-33. Electrical Diagram - Page 1 of 2 6-38
6-34. Electrical Diagram - Page 2 of 2 6-39
6-35. Hydraulic Components - H900067 RevE - Page 1 of 2 6-40
6-36. Hydraulic Components - H900067 RevD - Sheet 2 of 2 6-41
6-37. Hydraulic Schematic - 1001091321 RevC 6-42

LIST OF TABLES

TABLE NO.	TITLE	PAGE NO.
1-1	Operating Specifications	1-1
1-2	Dimensional Data	1-1
1-3	Capacities	1-1
1-4	Engine Specifications	1-2
1-5	Engine Battery Specifications	1-2
1-6	Tire Specifications	1-2
1-7	Pressure Settings	1-4
1-8	Major Component Weights	1-4
1-9	Critical Stability Weights	1-4
1-10	Hydraulic Oil	1-4
1-11	Mobil Hydraulic Oil Specs	1-4
2-1	Inspection and Maintenance	2-2
2-2	Lubrication Specifications	2-4
2-3	Preventive Maintenance and Safety Inspection	2-11
3-1	Torque Hub Technical Specifications	3-3
3-2	Drive Motor Specs	3-7
3-3	Tightening Torques	3-8
3-4	Engine Technical Data	3-14
3-5	Variable Displacement Axial Piston Pump Specs	3-18
3-6	Joystick Specifications	3-28
3-7	Plug Loading Chart	3-28
3-8	Beacon Harness MTB Connections	3-37
4-1	Steer Cylinder Specs	4-12
4-2	Outrigger Cylinder Specs	4-13
4-3	Axle Locking Cylinder Specs	4-14
4-4	Deck Extension Cylinder Specs	4-15
5-1	J1 Connector	5-3
5-2	J2 Connector	5-3
5-3	J3 Connector	5-3
5-4	Complex 2 Circuit Board	5-4
5-5	NIVOLUX Circuit Board	5-7
5-6	PNP Circuit Board - I/O	5-8
5-7	Connector J1	5-8
5-8	Connector J2	5-8
5-9	Connector CON1	5-9
5-10	Trigger Control Circuit Board	5-9
5-11	Limit Switches	5-10
5-12	Deutz Engine Control Board	5-12
5-13	Deutz Engine	5-12
6-1	Main Terminal Box Wiring Description	6-27

SECTION 1. SPECIFICATIONS

1.1 OPERATING SPECIFICATIONS

Table 1-1. Operating Specifications

Parameter	80SL
Maximum Working Height: with outriggers deployed with outriggers stowed	 87 ft (26.5 m) 72 ft (22 m)
Maximum Platform Height: with outriggers deployed with outriggers stowed	 80 ft (24.5 m) 65 ft (19.8 m)
Turning Radius : Inside Outside	 14.5 ft (4.4 m) 20.3 ft (6.1 M)
Wheelbase	12.8 ft (3.9 m)
Maximum Work Load (Capacity) - Main Platform/Platform Extension	1650 lbs (750 kg)
Maximum Occupants	4
Tools and Equipment	1300 lbs (590 kg)
Maximum Horizontal Manual Side Force	200 lb force (890 N)
Tilt Sensor Setting	3°
Maximum Operating Wind Speed	28 mph (12.5 m/s)
Gross Machine Weight (Approximate)	36,960 lbs (16,765 kg)
Drive Speed (slow)	0.4 mph (0.6 ft/sec) (0.2 m/s)
Drive Speed (fast)	1.9 mph (0.86 m/s)
Sideslope (Machine Stowed)	5°
Gradeability (MachineStowed)	25%
Lift Speed (no load)	125 sec
Lowering Speed	80 sec
Maximum Operating Hydraulic Pressure	3046 psi (210 bar)
Power Supply	Diesel Engine
Maximum Ground Bearing Pressure: Outriggers Tires	 128 psi (9 kg/cm^2) 85 psi (6 kg/cm^2)
Maximum Outrigger Pad Load	17,020 lbs (7720 kg)
Maximum Tire Load Rating	14,595 lbs (6620 kg)
Electrical System Voltage	24 V
Ground Clearance	10.8 in. (27.4 cm)

1.2 DIMENSIONAL DATA

Table 1-2. Dimensional Data

Parameter	80SL
Machine Height (rails up)	13.9 ft (4.24 m)
Machine Height (rails down)	10.4 ft (3.16 m)
Machine Width	8.3 ft (2.53 m)
Machine Length	19 ft (5.78 m)
Platform dimensions (extension retracted)	8.2 x 17.8 ft (2.5 x 5.4 m)
Platform dimensions (extension extended)	8.2 x 25.6 ft (2.5 x 7.8 m)
Transport Dimensions (L x W x H))	19 x 8.3 x 10.4 ft (5.78 x 2.5 x 3.16 m)

1.3 CAPACITIES

Table 1-3. Capacities

Fuel Tank	23.8 gal (90 L)
Hydraulic Tank	68.7 gal (260 L)
Engine Crankcase with Filter without Filter	 11 qt (10.5 L) 10.6 qt (10 L)

1.4 ENGINE

Table 1-4. Engine Specifications

Type	Deutz F4L 2011; or Deutz D2011 L04 i
Displacement	3108 cm^3
Bore	94 mm
Stroke	112 mm
Power	42 kW
Fuel Type	Diesel
Engine High Speed	2300 l/min
Engine Low Speed	850 l/min
Voltage	24 Volt

Table 1-5. Engine Battery Specifications

Voltage	12V
Amp Hour	100
Amp	880

1.5 TIRES

Table 1-6. Tire Specifications

Size	315/80R 22.5 Foam Filled
Pressure	101.5 psi (7.0 bar)
Wheel Lug Nut Torque: Front Axle: Rear Axle:	 480 Nm (354 ft lbs) 480 Nm (354 ft lbs)
Bolt Size	M18 x 1.5

1.6 TORQUE REQUIREMENTS

NOTE: *JLG recommends that once any locknut is removed from the machine it is discarded and replaced with a new one. When maintenance becomes necessary or a fastener has loosened, refer to Figure 1-3., Torque Chart (SAE Fasteners - Sheet 1 of 3) to Figure 1-8., Torque Chart (METRIC Fasteners - Sheet 3 of 3) to determine proper torque value.*

1.7 SENSORS

Platform Stowed/Jacks Retract Limit Switch

Switch that senses when the platform is lowered to 10.5 ft (3.2 m). Cuts out lowering function, enables drive function when tilted, and enables outriggers retract when outriggers are deployed.

High Drive Speed Cutout Limit Switch

When the platform reaches and exceeds a height of 12.1 ft (3.7 m), the fast drive speed will be cut back to the slow drive speed. Once the platform is completely lowered the high drive speed is possible. The warning LED will be out when this limit is exceeded.

Maximum Drive Height/Maximum Height without Outriggers Limit Switch

The drive function will be disabled once the platform reaches a height of 65 ft (19.8 m). The platform must be lowered below the limit to enable the drive function. The lift function is also disabled once the platform reaches a height of 65 ft (19.8 m) when the outriggers are not deployed.

Maximum Height Limit Switch

Once the platform has reached it's maximum height of 80 ft (24.5 m), the lifting function will be cut off by the maximum height limit switch. When maximum height is reached, the Lift Cutout Indicator LED on the platform control console will no longer be illuminated.

Tilt Sensor

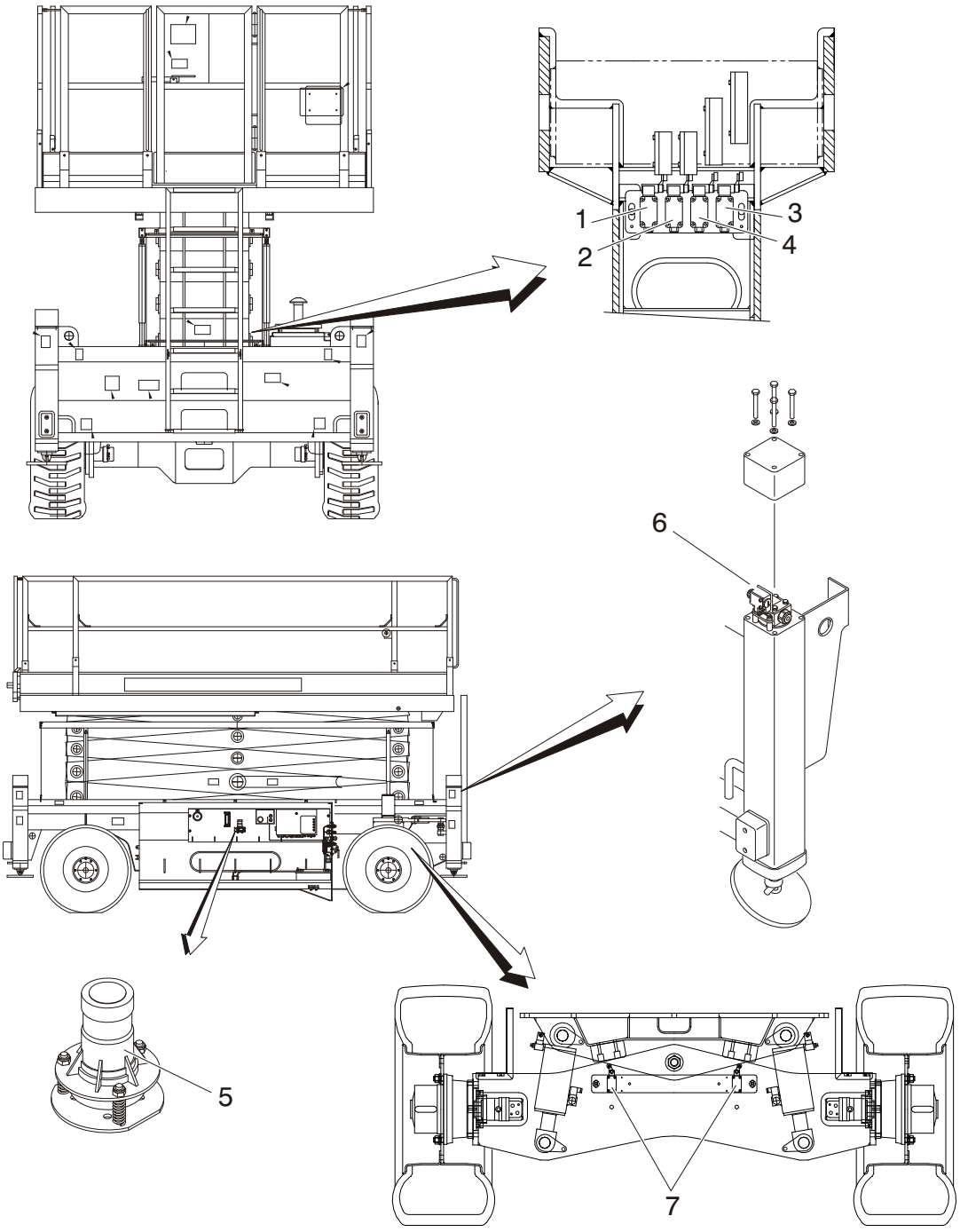
The tilt switch cuts out lifting, driving, and steering once the platform reaches a tilt angle (slope) beyond 3° and the platform height exceeds 12.1 ft (3.7 m). At this point, the warning LED on the platform control console will illuminate and lowering is the only function possible.

Outrigger Sensors

Outriggers Selected - Limit switch senses ground contact for all outriggers to enable platform to be raised.
Outriggers Not Selected - Limit switch senses when all outriggers are retracted to enable platform to be raised and machine to be driven.

Oscillating Axle Limit Switch

When the platform is raised above 12.8 ft (3.9 m) and the axle inclination is >1°, the drive function is cutout by a limit switch. When the platform is below 12.8 ft, the inclination of the axle is ignored and driving is possible.



1. Platform Stowed/Jacks Retract Limit Switch
2. High Drive Speed Cutout Limit Switch
3. Maximum Drive Height/Maximum Height without Outriggers Limit Switch
4. Maximum Height Limit Switch
5. Tilt Sensor
6. Outrigger Sensor (all 4 outriggers)
7. Oscillating Axle Limit Switches (rear axle)

Figure 1-1. Limit Switch Locations

1.8 PRESSURE SETTING

Cold temperatures have a significant impact on pressure readings. JLG Industries Inc. recommends setting the pressures with the operating temperature between 59° - 68°F (15°- 20°C). JLG Industries Inc. also recommends the use of a calibrated gauge. The pressures may be set with a tolerence of 43.5 psi (± 3 bar).

Table 1-7. Pressure Settings

Main Pressure Relief ±43.5 psi (3 bar)	3046 psi (210 bar)
Pump Charge Pressure ±43.5 psi (3 bar)	203 psi (14 bar)

1.9 MAJOR COMPONENT WEIGHTS

Table 1-8. Major Component Weights

Component	80SL
Platform Assembly (including extension)	2414 lbs (1095 kg)
Platform Extension	1058 lbs (480 kg)
Chassis	12,787 lbs (5800 kg)
Arm Assembly	15,653 lbs (7100 kg)
Lift Cylinder	1821 lbs (826 kg)

1.10 CRITICAL STABILITY WEIGHTS

NOTICE

DO NOT REPLACE ITEMS CRITICAL TO STABILITY, SUCH AS BATTERIES OR SOLID TIRES, WITH ITEMS OF DIFFERENT-WEIGHT OR SPECIFICATION. DO NOT MODIFY UNIT IN ANY WAY TO AFFECT STABILITY.

Table 1-9. Critical Stability Weights

Component	80SL
Wheel and Tire Assembly (each)	573 lbs (260 kg)
Wheel/Tire and Drive Assembly (each)	675 lbs (306 kg)
Batteries - Standard (each)	54.2 lbs (24.6 kg)

1.11 LUBRICATION

Hydraulic Oil

Table 1-10. Hydraulic Oil

HYDRAULIC SYSTEM OPERATING TEMPERATURE RANGE	SAE VISCOSITY GRADE
0° to +23°F (-18° to -5°C)	10W
0° to +210°F (-18° to +100°C)	10W-20, 10W-30
+50° to +210°F (+10° to +100°C)	20W-20

NOTE: *Hydraulic oils must have anti-wear qualities at least to API Service Classification GL-3, and sufficient chemical stability for mobile hydraulic system service. JLG Industries recommends Mobilfluid 424 hydraulic oil, which has an SAE viscosity index of 152.*

When temperatures remain below 20°F (-7°C), JLG Industries recommends the use of Mobil DTE13M.

Aside from JLG recommendations, it is not advisable to mix oils of different brands or types, as they may not contain the same required additives or be of comparable viscosities. If use of hydraulic oil other than Mobilfluid 424 is desired, contact JLG Industries for proper recommendations.

Table 1-11. Mobil Hydraulic Oil Specs

Description	Mobil 424	Mobil DTE 13M	Mobil EAL 46 (Envirosyn H 46)
ISO Viscosity Grade	10W-30	#32	46
Specific Gravity	29.0	0.877	0.922
Pour Point, Max	-46°C (-43°F)	-40°C (-40°F)	-39°C (-38.2°F)
Flash Point, Min.	228°C (442°F)	166°C (330°F)	310°C (590°F)
Viscosity			
at 40° C (104°F) at 100°C (212°F) Viscosity Index	55 cSt 9.3 cSt 152	33 cSt 6.5 cSt 140	47 cSt 9 cSt 176

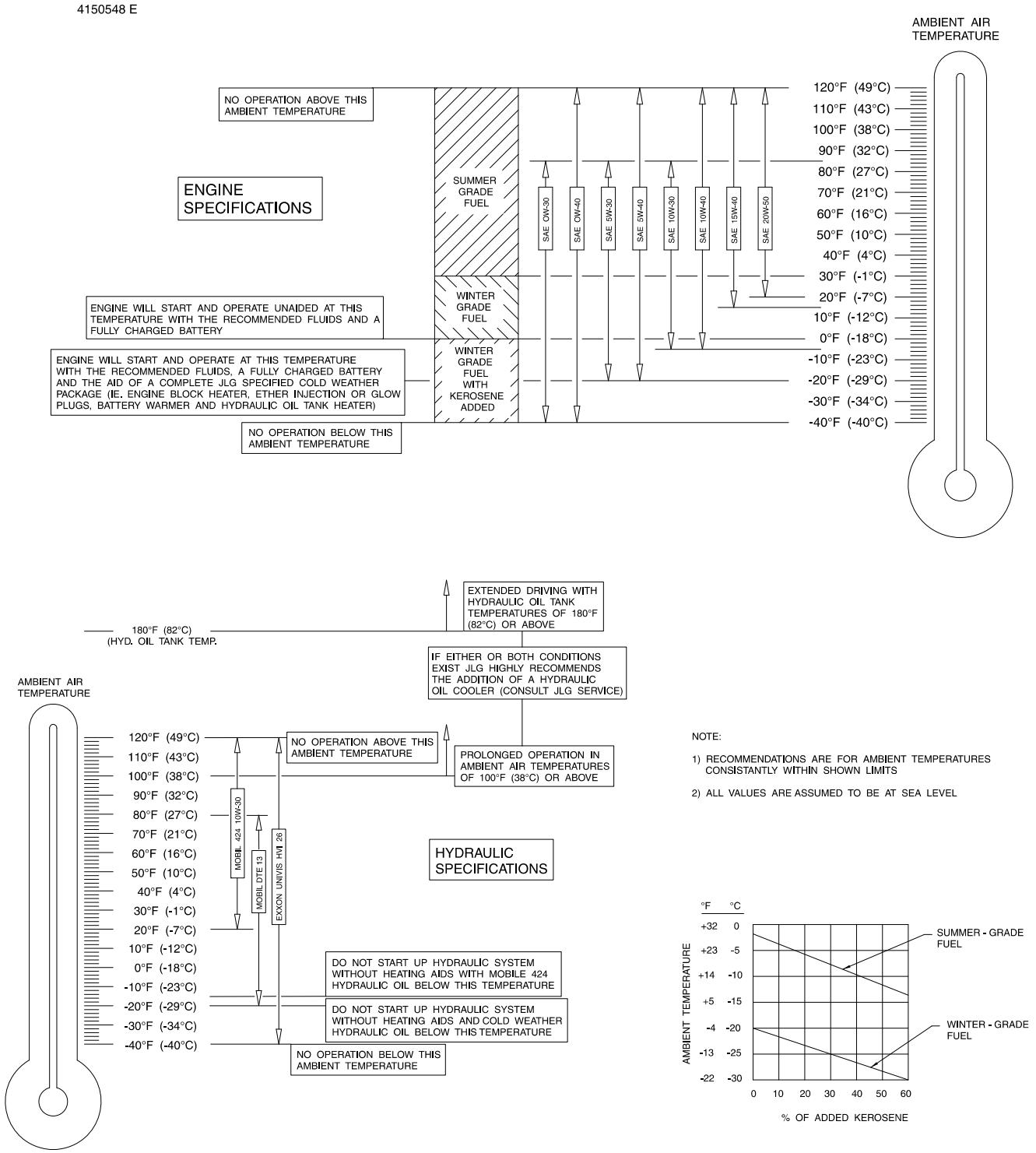

4150548 E
AMBIENT AIR TEMPERATURE
NO OPERATION ABOVE THIS AMBIENT TEMPERATURE
ENGINE SPECIFICATIONS
SUMMER GRADE FUEL
WINTER GRADE FUEL
WINTER GRADE FUEL WITH KEROSENE ADDED
SAE 0W-30
SAE 0W-40
SAE 5W-20
SAE 5W-40
SAE 10W-30
SAE 10W-40
SAE 15W-40
SAE 20W-50
ENGINE WILL START AND OPERATE UNAIDED AT THIS TEMPERATURE WITH THE RECOMMENDED FLUIDS AND A FULLY CHARGED BATTERY
ENGINE WILL START AND OPERATE AT THIS TEMPERATURE WITH THE RECOMMENDED FLUIDS, A FULLY CHARGED BATTERY AND THE AID OF A COMPLETE JLG SPECIFIED COLD WEATHER PACKAGE (IE. ENGINE BLOCK HEATER, ETHER INJECTION OR GLOW PLUGS, BATTERY WARMER AND HYDRAULIC OIL TANK HEATER)
NO OPERATION BELOW THIS AMBIENT TEMPERATURE
120°F (49°C)
110°F (43°C)
100°F (38°C)
90°F (32°C)
80°F (27°C)
70°F (21°C)
60°F (16°C)
50°F (10°C)
40°F (4°C)
30°F (-1°C)
20°F (-7°C)
10°F (-12°C)
0°F (-18°C)
-10°F (-23°C)
-20°F (-29°C)
-30°F (-34°C)
-40°F (-40°C)
EXTENDED DRIVING WITH HYDRAULIC OIL TANK TEMPERATURES OF 180°F (82°C) OR ABOVE
180°F (82°C) (HYD. OIL TANK TEMP.
IF EITHER OR BOTH CONDITIONS EXIST JLG HIGHLY RECOMMENDS THE ADDITION OF A HYDRAULIC OIL COOLER (CONSULT JLG SERVICE)
AMBIENT AIR TEMPERATURE
NO OPERATION ABOVE THIS AMBIENT TEMPERATURE
PROLONGED OPERATION IN AMBIENT AIR TEMPERATURES OF 100°F (38°C) OR ABOVE
MOBIL 424 10W-30
MOBIL DTE 13
EXXON UNIVIS HVI 26
HYDRAULIC SPECIFICATIONS
DO NOT START UP HYDRAULIC SYSTEM WITHOUT HEATING AIDS WITH MOBILE 424 HYDRAULIC OIL BELOW THIS TEMPERATURE
DO NOT START UP HYDRAULIC SYSTEM WITHOUT HEATING AIDS AND COLD WEATHER HYDRAULIC OIL BELOW THIS TEMPERATURE
NO OPERATION BELOW THIS AMBIENT TEMPERATURE
NOTE:
1) RECOMMENDATIONS ARE FOR AMBIENT TEMPERATURES CONSISTANTLY WITHIN SHOWN LIMITS
2) ALL VALUES ARE ASSUMED TO BE AT SEA LEVEL
°F °C
+32 0
+23 -5
+14 -10
+5 -15
-4 -20
-13 -25
-22 -30
AMBIENT TEMPERATURE
0 10 20 30 40 50 60
% OF ADDED KEROSENE
SUMMER - GRADE FUEL
WINTER - GRADE FUEL

Figure 1-2. Engine Operating Temperature Specifications

1.12 TORQUE CHARTS

VALUES FOR ZINC PLATED / YELLOW CHROMATE FASTENERS ONLY								
SAE GRADE 5 BOLTS & GRADE 2 NUTS								
SIZE	TPI	BOLT DIA	TENSILE STRESS AREA	CLAMP LOAD	TORQUE (DRY OR LOCTITE 263)	TORQUE (LUB)	TORQUE (LOCTITE 262)	TORQUE (LOCTITE) (242 OR 271)
		IN	SQ IN	LB	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]
4	40	0.1120	0.00604	380	8 [.9]	6 [.7]		
	48	0.1120	0.00661	420	9 [1.0]	7 [.8]		
6	32	0.1380	0.00909	580	16 [1.8]	12 [1.4]		
	40	0.1380	0.01015	610	18 [2.0]	13 [1.5]		
8	32	0.1640	0.01400	900	30 [3.5]	22 [2.5]		
	36	0.1640	0.01474	940	31 [4]	23 [2.6]		
10	24	0.1900	0.01750	1120	43 [5]	32 [3.5]		
	32	0.1900	0.02000	1285	49 [5.5]	36 [4]		
1/4	20	0.2500	0.0318	2020	96 [11]	75 [9]		105 [12]
	28	0.2500	0.0364	2320	120 [14]	86 [10]		135 [15]
		IN	SQ IN	LB	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]
5/16	18	0.3125	0.0524	3340	17 [23]	13 [18]	16 [22]	19 [26]
	24	0.3125	0.0580	3700	19 [26]	14 [19]	17 [23]	21 [29]
3/8	16	0.3750	0.0775	4940	30 [41]	23 [31]	28 [38]	35 [47]
	24	0.3750	0.0878	5600	35 [47]	25 [34]	32 [43]	40 [54]
7/16	14	0.4375	0.1063	6800	50 [68]	35 [47]	45 [61]	55 [75]
	20	0.4375	0.1187	7550	55 [75]	40 [54]	50 [68]	60 [81]
1/2	13	0.5000	0.1419	9050	75 [102]	55 [75]	68 [92]	85 [115]
	20	0.5000	0.1599	10700	90 [122]	65 [88]	80 [108]	100 [136]
9/16	12	0.5625	0.1820	11600	110 [149]	80 [108]	98 [133]	120 [163]
	18	0.5625	0.2030	12950	120 [163]	90 [122]	109 [148]	135 [183]
5/8	11	0.6250	0.2260	14400	150 [203]	110 [149]	135 [183]	165 [224]
	18	0.6250	0.2560	16300	170 [230]	130 [176]	153 [207]	190 [258]
3/4	10	0.7500	0.3340	21300	260 [353]	200 [271]	240 [325]	285 [386]
	16	0.7500	0.3730	23800	300 [407]	220 [298]	268 [363]	330 [447]
7/8	9	0.8750	0.4620	29400	430 [583]	320 [434]	386 [523]	475 [644]
	14	0.8750	0.5090	32400	470 [637]	350 [475]	425 [576]	520 [705]
1	8	1.0000	0.6060	38600	640 [868]	480 [651]	579 [785]	675 [915]
	12	1.0000	0.6630	42200	700 [949]	530 [719]	633 [858]	735 [997]
1 1/8	7	1.1250	0.7630	42300	800 [1085]	600 [813]	714 [968]	840 [1139]
	12	1.1250	0.8560	47500	880 [1193]	660 [895]	802 [1087]	925 [1254]
1 1/4	7	1.2500	0.9690	53800	1120 [1518]	840 [1139]	1009 [1368]	1175 [1593]
	12	1.2500	1.0730	59600	1240 [1681]	920 [1247]	1118 [1516]	1300 [1763]
1 3/8	6	1.3750	1.1550	64100	1460 [1979]	1100 [1491]	1322 [1792]	1525 [2068]
	12	1.3750	1.3150	73000	1680 [2278]	1260 [1708]	1506 [2042]	1750 [2373]
1 1/2	6	1.5000	1.4050	78000	1940 [2630]	1460 [1979]	1755 [2379]	2025 [2746]
	12	1.5000	1.5800	87700	2200 [2983]	1640 [2224]	1974 [2676]	2300 [3118]

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NOTE: THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

SAE GRADE 5 SAE GRADE 8

Figure 1-3. Torque Chart (SAE Fasteners - Sheet 1 of 3)

VALUES FOR ZINC PLATED / YELLOW CHROMATE FASTENERS ONLY SAE GRADE 8 BOLTS & GRADE 8 NUTS, & SOCKET HEAD CAP SCREWS #6 THRU 1/4								
SIZE	TPI	BOLT DIA	TENSILE STRESS AREA	CLAMP LOAD	TORQUE (DRY OR LOCTITE 263)	TORQUE (LUB)	TORQUE (LOCTITE 262)	TORQUE (LOCTITE) (242 OR 271)
		IN	SQ IN	LB	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]
4	40	0.1120	0.00604	540	12 [1.4]	9 [1.0]		
	48	0.1120	0.00661	600	13 [1.5]	10 [1.1]		
6	32	0.1380	0.00909	820	23 [2.6]	17 [1.9]		
	40	0.1380	0.01015	920	25 [2.8]	19 [2.2]		
8	32	0.1640	0.01400	1260	41 [4.5]	31 [3.5]		
	36	0.1640	0.01474	1320	43 [5]	32 [4]		
10	24	0.1900	0.01750	1580	60 [7]	45 [5]		
	32	0.1900	0.02000	1800	68 [8]	51 [6]		
1/4	20	0.2500	0.0318	2860	144 [16]	108 [12]		160 [18]
	28	0.2500	0.0364	3280	168 [19]	120 [14]		185 [21]
		IN	SQ IN	LB	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]
5/16	18	0.3125	0.0524	4720	25 [34]	18 [24]	22 [30]	30 [41]
	24	0.3125	0.0580	5220	25 [34]	20 [27]	25 [34]	30 [41]
3/8	16	0.3750	0.0775	7000	45 [61]	35 [47]	40 [54]	50 [68]
	24	0.3750	0.0878	7900	50 [68]	35 [47]	45 [61]	55 [75]
7/16	14	0.4375	0.1063	9550	70 [95]	55 [75]	63 [85]	80 [108]
	20	0.4375	0.1187	10700	80 [108]	60 [81]	70 [95]	90 [122]
1/2	13	0.5000	0.1419	12750	110 [149]	80 [108]	96 [130]	120 [163]
	20	0.5000	0.1599	14400	120 [163]	90 [122]	108 [146]	135 [183]
9/16	12	0.5625	0.1820	16400	150 [203]	110 [149]	139 [188]	165 [224]
	18	0.5625	0.2030	18250	170 [230]	130 [176]	154 [209]	190 [258]
5/8	11	0.6250	0.2260	20350	220 [298]	170 [230]	180 [244]	240 [325]
	18	0.6250	0.2560	23000	240 [325]	180 [244]	204 [277]	265 [359]
3/4	10	0.7500	0.3340	30100	380 [515]	280 [380]	301 [408]	420 [569]
	16	0.7500	0.3730	33600	420 [569]	320 [434]	336 [456]	465 [630]
7/8	9	0.8750	0.4620	41600	600 [813]	460 [624]	485 [658]	660 [895]
	14	0.8750	0.5090	45800	660 [895]	500 [678]	534 [724]	725 [983]
1	8	1.0000	0.6060	51500	900 [1220]	680 [922]	687 [931]	990 [1342]
	12	1.0000	0.6630	59700	1000 [1356]	740 [1003]	796 [1079]	1100 [1491]
1 1/8	7	1.1250	0.7630	68700	1280 [1735]	960 [1302]	1030 [1396]	1400 [1898]
	12	1.1250	0.8560	77000	1440 [1952]	1080 [1464]	1155 [1607]	1575 [2135]
1 1/4	7	1.2500	0.9690	87200	1820 [2468]	1360 [1844]	1453 [1970]	2000 [2712]
	12	1.2500	1.0730	96600	2000 [2712]	1500 [2034]	1610 [2183]	2200 [2983]
1 3/8	6	1.3750	1.1550	104000	2380 [3227]	1780 [2413]	1907 [2586]	2625 [3559]
	12	1.3750	1.3150	118100	2720 [3688]	2040 [2765]	2165 [2935]	3000 [4067]
1 1/2	6	1.5000	1.4050	126500	3160 [4284]	2360 [3200]	2530 [3430]	3475 [4711]
	12	1.5000	1.5800	142200	3560 [4827]	2660 [3606]	2844 [3856]	3925 [5322]

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NOTE: THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

SAE GRADE 5 SAE GRADE 8

Figure 1-4. Torque Chart (SAE Fasteners - Sheet 2 of 3))

JLG SPECIFICATION #4150701- MAGNA 565							
SOCKET HEAD CAP SCREWS 5/16 & ABOVE							
SIZE	TPI	BOLT DIA	TENSILE STRESS AREA	CLAMP LOAD	TORQUE	TORQUE (LOCTITE 262)	TORQUE (LOCTITE) (242 OR 271)
		IN	SQ IN	LB	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]
4	40	0.1120	0.00604				
	48	0.1120	0.00661				
6	32	0.1380	0.00909				
	40	0.1380	0.01015				
8	32	0.1640	0.01400				
	36	0.1640	0.01474				
10	24	0.1900	0.01750				
	32	0.1900	0.02000				
1/4	20	0.2500	0.0318	2860	108 [12]		160 [18]
	28	0.2500	0.0364	3280	120 [14]		185 [21]
		IN	SQ IN	LB	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]
5/16	18	0.3125	0.0524	4720	18 [24]	22 [30]	30 [41]
	24	0.3125	0.0580	5220	20 [27]	25 [34]	30 [41]
3/8	16	0.3750	0.0775	7000	35 [47]	40 [54]	50 [68]
	24	0.3750	0.0878	7900	35 [47]	45 [61]	55 [75]
7/16	14	0.4375	0.1063	9550	55 [75]	63 [85]	80 [108]
	20	0.4375	0.1187	10700	60 [81]	70 [95]	90 [122]
1/2	13	0.5000	0.1419	12750	80 [108]	96 [130]	120 [163]
	20	0.5000	0.1599	14400	90 [122]	108 [146]	135 [183]
9/16	12	0.5625	0.1820	16400	110 [149]	139 [188]	165 [224]
	18	0.5625	0.2030	18250	130 [176]	154 [209]	190 [258]
5/8	11	0.6250	0.2260	20350	170 [230]	180 [244]	240 [325]
	18	0.6250	0.2560	23000	180 [244]	204 [277]	265 [359]
3/4	10	0.7500	0.3340	30100	280 [380]	301 [408]	420 [569]
	16	0.7500	0.3730	33600	320 [434]	336 [456]	465 [630]
7/8	9	0.8750	0.4620	41600	460 [624]	485 [658]	660 [895]
	14	0.8750	0.5090	45800	500 [678]	534 [724]	725 [983]
1	8	1.0000	0.6060	51500	680 [922]	687 [931]	990 [1342]
	12	1.0000	0.6630	59700	740 [1003]	796 [1079]	1100 [1491]
1 1/8	7	1.1250	0.7630	68700	960 [1302]	1030 [1396]	1400 [1898]
	12	1.1250	0.8560	77000	1080 [1464]	1155 [1607]	1575 [2135]
1 1/4	7	1.2500	0.9690	87200	1360 [1844]	1453 [1970]	2000 [2712]
	12	1.2500	1.0730	96600	1500 [2034]	1610 [2183]	2200 [2983]
1 3/8	6	1.3750	1.1550	104000	1780 [2413]	1907 [2586]	2625 [3559]
	12	1.3750	1.3150	118100	2040 [2765]	2165 [2935]	3000 [4067]
1 1/2	6	1.5000	1.4050	126500	2360 [3200]	2530 [3430]	3475 [4711]
	12	1.5000	1.5800	142200	2660 [3606]	2844 [3856]	3925 [5322]

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NOTE: THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

SAE GRADE 5 SAE GRADE 8

Figure 1-5. Torque Chart (SAE Fasteners - Sheet 3 of 3)

			VALUES FOR ZINC PLATED / YELLOW CHROMATE FASTENERS ONLY				
			CLASS 8.8 METRIC BOLTS CLASS 8 METRIC NUTS				
SIZE	PITCH	TENSILE STRESS AREA	CLAMP LOAD	TORQUE (DRY OR LOCTITE 263)	TORQUE (LUB)	TORQUE (LOCTITE 262)	TORQUE (LOCTITE) (242 OR 271)
		sq mm	KN	N.m	N.m	N.m	N.m
3	.5	5.03	2.19	1.3	1.0	1.2	1.4
3.5	.6	6.78	2.95	2.1	1.6	1.9	2.3
4	.7	8.78	3.82	3.1	2.3	2.8	3.4
5	.8	14.2	6.18	6.2	4.6	5.6	6.8
6	1	20.1	8.74	11	7.9	9.4	12
7	1	28.9	12.6	18	13	16	19
8	1.25	36.6	15.9	25	19	23	28
10	1.5	58.0	25.2	50	38	45	55
12	1.75	84.3	36.7	88	66	79	97
14	2	115	50.0	140	105	126	154
16	2	157	68.3	219	164	197	241
18	2.5	192	83.5	301	226	271	331
20	2.5	245	106.5	426	320	383	469
22	2.5	303	132.0	581	436	523	639
24	3	353	153.5	737	553	663	811
27	3	459	199.5	1080	810	970	1130
30	3.5	561	244.0	1460	1100	1320	1530
33	3.5	694	302.0	1990	1490	1790	2090
36	4	817	355.5	2560	1920	2300	2690
42	4.5	1120	487.0	4090	3070	3680	4290

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NOTE: THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

METRIC CLASS 8.8

METRIC CLASS 10.9

Figure 1-6. Torque Chart (METRIC Fasteners - Sheet 1 of 3)

			VALUES FOR ZINC PLATED / YELLOW CHROMATE FASTENERS ONLY				
			CLASS 10.9 METRIC BOLTS CLASS 10 METRIC NUTS CLASS 12.9 SOCKET HEAD CAP SCREWS M3-M5				
SIZE	PITCH	TENSILE STRESS AREA	CLAMP LOAD	TORQUE (DRY OR LOCTITE 263)	TORQUE (LUB)	TORQUE (LOCTITE 262)	TORQUE (LOCTITE) (242 OR 271)
		sq mm	KN	N.m	N.m	N.m	N.m
3	.5	5.03	3.13	1.9	1.4	1.5	2.1
3.5	.6	6.78	4.22	3.0	2.2	2.4	3.3
4	.7	8.78	5.47	4.4	3.3	3.5	4.8
5	.8	14.2	8.85	8.9	6.6	7.1	9.7
6	1	20.1	12.5	15	11	12	17
7	1	28.9	18.0	25	19	20	28
8	1.25	36.6	22.8	37	27	29	40
10	1.5	58.0	36.1	72	54	58	79
12	1.75	84.3	52.5	126	95	101	139
14	2	115	71.6	200	150	160	220
16	2	157	97.8	313	235	250	344
18	2.5	192	119.5	430	323	344	473
20	2.5	245	152.5	610	458	488	671
22	2.5	303	189.0	832	624	665	915
24	3	353	220.0	1060	792	845	1170
27	3	459	286.0	1540	1160	1240	1690
30	3.5	561	349.5	2100	1570	1680	2310
33	3.5	694	432.5	2600	2140	2280	2860
36	4	817	509.0	3660	2750	2930	4020
42	4.5	1120	698.0	5860	4400	4690	6440

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NOTE: THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

METRIC CLASS 8.8

METRIC CLASS 10.9

Figure 1-7. Torque Chart (METRIC Fasteners - Sheet 2 of 3))

			JLG SPECIFICATION #4150701- MAGNA 565			
			CLASS 12.9 SOCKET HEAD CAP SCREWS M6 AND ABOVE			
SIZE	PITCH	TENSILE STRESS AREA	CLAMP LOAD	TORQUE	TORQUE (LOCTITE 262)	TORQUE (LOCTITE) (242 OR 271)
		sq mm	KN	N.m	N.m	N.m
3	.5	5.03			1.5	2.1
3.5	.6	6.78			2.4	3.3
4	.7	8.78			3.5	4.8
5	.8	14.2			7.1	9.7
6	1	20.1	12.5	11	12	17
7	1	28.9	18.0	19	20	28
8	1.25	36.6	22.8	27	29	40
10	1.5	58.0	36.1	54	58	79
12	1.75	84.3	52.5	95	101	139
14	2	115	71.6	150	160	220
16	2	157	97.8	235	250	344
18	2.5	192	119.5	323	344	473
20	2.5	245	152.5	458	488	671
22	2.5	303	189.0	624	665	915
24	3	353	220.0	792	845	1170
27	3	459	286.0	1160	1240	1690
30	3.5	561	349.5	1570	1680	2310
33	3.5	694	432.5	2140	2280	2860
36	4	817	509.0	2750	2930	4020
42	4.5	1120	698.0	4400	4690	6440

NOTE: THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

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METRIC CLASS 8.8

METRIC CLASS 10.9

Figure 1-8. Torque Chart (METRIC Fasteners - Sheet 3 of 3)

NOTES:

SECTION 2. GENERAL

2.1 MACHINE PREPARATION, INSPECTION, AND MAINTENANCE

General

This section provides the necessary information needed by those personnel that are responsible to place the machine in operation readiness and maintain its safe operating condition. For maximum service life and safe operation, ensure that all the necessary inspections and maintenance have been completed before placing the machine into service.

Preparation, Inspection, and Maintenance

It is important to establish and conform to a comprehensive inspection and preventive maintenance program. The following table outlines the periodic machine inspections and maintenance recommended by JLG Industries, Inc. Consult your national, regional, or local regulations for further requirements for aerial work platforms. The frequency of inspections and maintenance must be increased as environment, severity and frequency of usage requires.

Pre-Start Inspection

It is the User's or Operator's primary responsibility to perform a Pre-Start Inspection of the machine prior to use daily or at each change of operator. Reference the Operator's and Safety Manual for completion procedures for the Pre-Start Inspection. The Operator and Safety Manual must be read in its entirety and understood prior to performing the Pre-Start Inspection.

Pre-Delivery Inspection and Frequent Inspection

The Pre-Delivery Inspection and Frequent Inspection shall be performed by a qualified JLG equipment mechanic. JLG Industries, Inc. recognizes a qualified JLG equipment mechanic as a person who, by possession of a recognized degree, certificate, extensive knowledge, training, or experience, has successfully demonstrated the ability and proficiency to service, repair, and maintain the subject JLG product model.

The Pre-Delivery Inspection and Frequent Inspection procedures are performed in the same manner, but at different times. The Pre-Delivery Inspection shall be performed prior to each sale, lease, or rental delivery. The Frequent Inspection shall be accomplished for each machine in service for 3 months or 150 hours (whichever comes first); out of service for a period of more than 3 months; or when purchased used. The frequency of this inspection must be increased as environment, severity and frequency of usage requires.

Reference the JLG Pre-Delivery and Frequent Inspection Form and the Inspection and Preventative Maintenance Schedule for items requiring inspection during the performance of these inspections. Reference the appropriate areas of this manual for servicing and maintenance procedures.

Annual Machine Inspection

JLG recommends that the Annual Machine Inspection be performed by a Factory-Certified Service Technician on an annual basis, no later than thirteen (13) months from the date of the prior Annual Machine Inspection. JLG Industries, Inc. recognizes a Factory-Certified Service Technician as a person who has successfully completed the JLG Service Training School for the subject JLG product model. Reference the machine Service and Maintenance Manual and appropriate JLG inspection form for performance of this inspection.

Reference the JLG Annual Machine Inspection Form and the Inspection and Preventative Maintenance Schedule for items requiring inspection during the performance of this inspection. Reference the appropriate areas of this manual for servicing and maintenance procedures.

For the purpose of receiving safety-related bulletins, it is important that JLG Industries, Inc. has updated ownership information for each machine. When performing each Annual Machine Inspection, notify JLG Industries, Inc. of the current machine ownership.

Preventative Maintenance

In conjunction with the specified inspections, maintenance shall be performed by a qualified JLG equipment mechanic. JLG Industries, Inc. recognizes a qualified JLG equipment mechanic as a person who, by possession of a recognized degree, certificate, extensive knowledge, training, or experience, has successfully demonstrated the ability and proficiency to service, repair, and maintain the subject JLG product model.

Reference the Preventative Maintenance Schedule and the appropriate areas of this manual for servicing and maintenance procedures. The frequency of service and maintenance must be increased as environment, severity and frequency of usage requires.

Table 2-1. Inspection and Maintenance

Type	Frequency	Primary Responsibility	Service Qualification	Reference
Pre-Start Inspection	Prior to use each day; or At each Operator change.	User or Operator	User or Operator	Operator and Safety Manual
Pre-Delivery Inspection	Prior to each sale, lease, or rental delivery.	Owner, Dealer, or User	Qualified JLG Mechanic	Service and Maintenance Manual and applicable JLG inspection form.
Frequent Inspection	In service for 3 months or 150 hours, whichever comes first; or Out of service for a period of more than 3 months; or Purchased used.	Owner, Dealer, or User	Qualified JLG Mechanic	Service and Maintenance Manual and applicable JLG inspection form.
Annual Machine Inspection	Annually, no later than 13 months from the date of the prior inspection.	Owner, Dealer, or User	Factory-Certified Service Technician (recommended)	Service and Maintenance Manual and applicable JLG inspection form.
Preventative Maintenance	At intervals as specified in the Service and Maintenance Manual.	Owner, Dealer, or User	Qualified JLG Mechanic	Service and Maintenance Manual

2.2 SERVICE AND GUIDELINES

General

The following information is provided to assist you in the use and application of servicing and maintenance procedures contained in this book.

Safety and Workmanship

Your safety, and that of others, is the first consideration when engaging in the maintenance of equipment. Always be conscious of weight. Never attempt to move heavy parts without the aid of a mechanical device. Do not allow heavy objects to rest in an unstable position. When raising a portion of the equipment, ensure that adequate support is provided.

Cleanliness

1. The most important single item in preserving the long service life of a machine is to keep dirt and foreign materials out of the vital components. Precautions have been taken to safeguard against this. Shields, covers, seals, and filters are provided to keep air, fuel, and oil supplies clean; however, these items must be maintained on a scheduled basis in order to function properly.
2. At any time when air, fuel, or oil lines are disconnected, clear adjacent areas as well as the openings and fittings themselves. As soon as a line or component is disconnected, cap or cover all openings to prevent entry of foreign matter.
3. Clean and inspect all parts during servicing or maintenance, and assure that all passages and openings are unobstructed. Cover all parts to keep them clean. Be sure all parts are clean before they are installed. New parts should remain in their containers until they are ready to be used.

Components Removal and Installation

1. Use adjustable lifting devices, whenever possible, if mechanical assistance is required. All slings (chains, cables, etc.) should be parallel to each other and as near perpendicular as possible to top of part being lifted.
2. Should it be necessary to remove a component on an angle, keep in mind that the capacity of an eyebolt or similar bracket lessens, as the angle between the supporting structure and the component becomes less than 90°.
3. If a part resists removal, check to see whether all nuts, bolts, cables, brackets, wiring, etc., have been removed and that no adjacent parts are interfering.

Component Disassembly and Reassembly

When disassembling or reassembling a component, complete the procedural steps in sequence. Do not partially disassemble or assemble one part, then start on another. Always recheck your work to assure that nothing has been overlooked. Do not make any adjustments, other than those recommended, without obtaining proper approval.

Pressure-Fit Parts

When assembling pressure-fit parts, use an anti-seize or molybdenum disulfide base compound to lubricate the mating surface.

Bearings

1. When a bearing is removed, cover it to keep out dirt and abrasives. Clean bearings in nonflammable cleaning solvent and allow to drip dry. Compressed air can be used but do not spin the bearing.
2. Discard bearings if the races and balls (or rollers) are pitted, scored, or burned.
3. If bearing is found to be serviceable, apply a light coat of oil and wrap it in clean (waxed) paper. Do not unwrap reusable or new bearings until they are ready to install.
4. Lubricate new or used serviceable bearings before installation. When pressing a bearing into a retainer or bore, apply pressure to the outer race. If the bearing is to be installed on a shaft, apply pressure to the inner race.

Gaskets

Check that holes in gaskets align with openings in the mating parts. If it becomes necessary to hand-fabricate a gasket, use gasket material or stock of equivalent material and thickness. Be sure to cut holes in the right location, as blank gaskets can cause serious system damage.

Bolt Usage and Torque Application

1. Use bolts of proper length. A bolt which is too long will bottom before the head is tight against its related part. If a bolt is too short, there will not be enough thread area to engage and hold the part properly. When replacing bolts, use only those having the same specifications of the original, or one which is equivalent.
2. Unless specific torque requirements are given within the text, standard torque values should be used on heat-treated bolts, studs, and steel nuts, in accordance with recommended shop practices. (See Torque Chart Section 1.)

Hydraulic Lines and Electrical Wiring

Clearly mark or tag hydraulic lines and electrical wiring, as well as their receptacles, when disconnecting or removing them from the unit. This will assure that they are correctly reinstalled.

Hydraulic System

1. Keep the system clean. If evidence of metal or rubber particles are found in the hydraulic system, drain and flush the entire system.
2. Disassemble and reassemble parts on clean work surface. Clean all metal parts with non-flammable cleaning solvent. Lubricate components, as required, to aid assembly.

Lubrication

Service applicable components with the amount, type, and grade of lubricant recommended in this manual, at the specified intervals. When recommended lubricants are not available, consult your local supplier for an equivalent that meets or exceeds the specifications listed.

Battery

Clean battery, using a non-metallic brush and a solution of baking soda and water. Rinse with clean water. After cleaning, thoroughly dry battery and coat terminals with an anti corrosion compound.

Lubrication and Servicing

Components and assemblies requiring lubrication and servicing are shown in the Lubrication Chart in Section 1.

2.3 LUBRICATION AND INFORMATION

Hydraulic System

1. The primary enemy of a hydraulic system is contamination. Contaminants enter the system by various means, e.g., using inadequate hydraulic oil, allowing moisture, grease, filings, sealing components, sand, etc., to enter when performing maintenance, or by permitting the pump to cavitate due to insufficient quantity of oil in supply tube.

2. The design and manufacturing tolerances of the component working parts are very close, therefore, even the smallest amount of dirt or foreign matter entering a system can cause wear or damage to the components and generally results in faulty operation. Every precaution must be taken to keep hydraulic oil clean, including reserve oil in storage. Hydraulic system filters should be checked, cleaned, and/or replaced as necessary, at the specified intervals required in the Lubrication Chart in Section 1. Always examine filters for evidence of metal particles.

3. Cloudy oils indicate a high moisture content which permits organic growth, resulting in oxidation or corrosion. If this condition occurs, the system must be drained, flushed, and refilled with clean oil.

4. It is not advisable to mix oils of different brands or types, as they may not contain the same required additives or be of comparable viscosities. Good grade mineral oils, with viscosities suited to the ambient temperatures in which the machine is operating, are recommended for use.

NOTE: *Metal particles may appear in the oil or filters of new machines due to the wear-in of meshing components.*

Hydraulic Oil

1. Refer to Section 1 for recommendations for viscosity ranges.

2. JLG recommends Mobilfluid 424 hydraulic oil, which has an SAE viscosity of 10W-30 and a viscosity index of 152.

NOTE: *Start-up of hydraulic system with oil temperatures below -15°F (-26°C) is not recommended. If it is necessary to start the system in a sub-zero environment, it will be necessary to heat the oil with a low density, electrical heater to a minimum temperature of -15°F (-26°C).*

Changing Hydraulic Oil

1. Use of any of the recommended crankcase or hydraulic oils eliminates the need for changing the oil on a regular basis. However, filter elements must be changed annually unless operating in extreme conditions. If it is necessary to change the oil, use only those oils meeting or exceeding the specifications appearing in this manual. If unable to obtain the same type of oil supplied with the machine, consult local supplier for assistance in selecting the proper equivalent. Avoid mixing petroleum and synthetic base oils. JLG Industries recommends changing the hydraulic oil annually.

2. Use every precaution to keep the hydraulic oil clean. If the oil must be poured from the original container into another, be sure to clean all possible contaminants from the service container. Always replace the filter and clean magnet any time the system oil is changed.

3. While the unit is shut down, a good preventive maintenance measure is to make a thorough inspection of all hydraulic components, lines, fittings, etc., as well as a functional check of each system, before placing the machine back in service.

Lubrication Specifications

Specified lubricants, as recommended by the component manufacturers, are always the best choice, however, multi-purpose greases usually have the qualities which meet a variety of single purpose grease requirements. Should any question arise, regarding the use of greases in maintenance stock, consult your local supplier for evaluation. Refer to Section 1 for an explanation of the lubricant key designations appearing in the Lubrication Chart.

Table 2-2. Lubrication Specifications

KEY	SPECIFICATIONS
MPG	Multipurpose Grease having a minimum dripping point of 350°F (177°C). Excellent water resistance and adhesive qualities, and being of extreme pressure type. (Timken OK 40 pounds minimum.)
EPGL	Extreme Pressure Gear Lube (oil) meeting API service classification GL-5 or MIL-Spec MIL-L-2105.
EO	Engine (crankcase) Oil. Gas - API SF/SG class, MIL-L-2104. Diesel - API CC/CD class, MIL-L-2104B/MIL-L-2104C.
HO	Hydraulic Oil. API service classification GL-3, e.g. Mobil 424.

2.4 OPERATOR MAINTENANCE

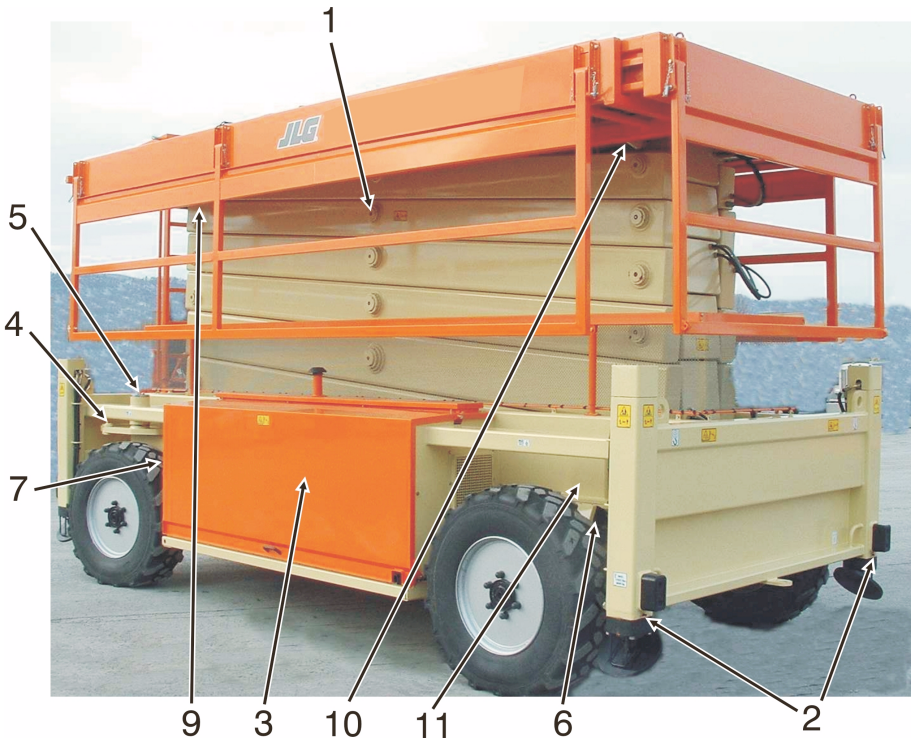
⚠ WARNING

TO AVOID PERSONAL INJURY, USE SAFETY PROPS FOR ALL MAINTENANCE REQUIRING PLATFORM TO BE ELEVATED.

NOTE: *Be sure to lubricate like items on each side.*

NOTE: *Recommended lubricating intervals are based on machine operations under normal conditions. For machines used in multi-shift operations and/or exposed to hostile environments or conditions, lubrication frequencies must be increased accordingly.*

Operate hydraulic functions through one complete cycle before checking hydraulic oil level in tank. Oil should be visible in ADD sight window on hydraulic tank. If oil is not visible, add oil until oil is visible in both ADD and FULL sight windows on tank. Do not overfill tank.

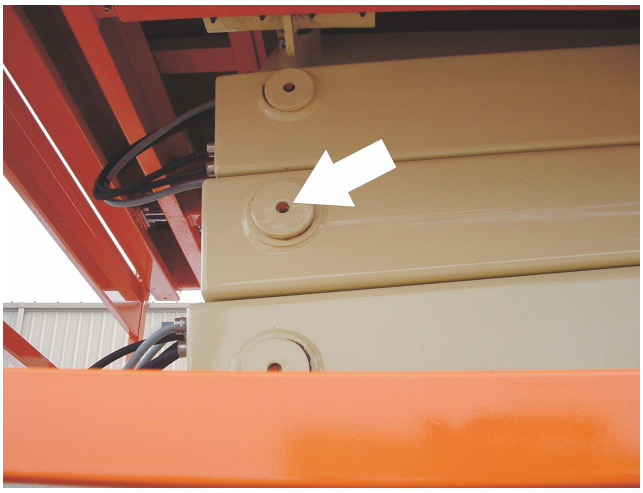


1. Arm Pins
2. Outrigger Cylinders
3. Engine Compartment
4. Tie Rod End
5. Spindles
6. Oscillating Axle
7. Lift Cylinder
8. Fuel Tank (Opposite Side)
9. Deck/Arm Pivot Pin
10. Upper Slide Pads
11. Lower Slide Pads

Figure 2-1. Lubrication Diagram

NOTE: *The following numbers correspond with those in Figure 2-1., Lubrication Diagram.*

1. Arm Pins

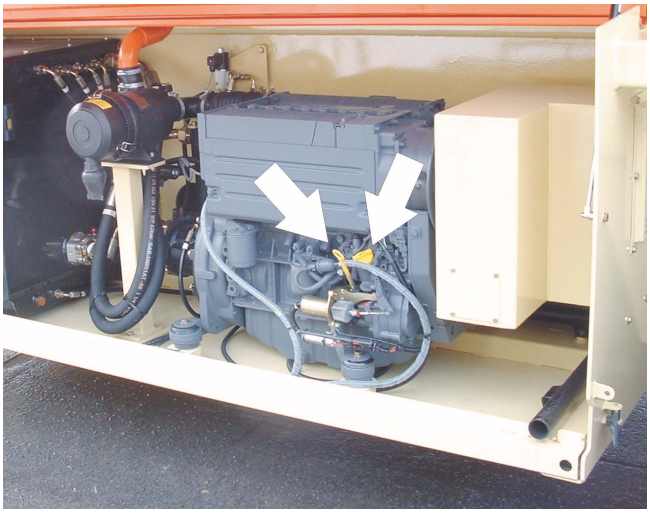


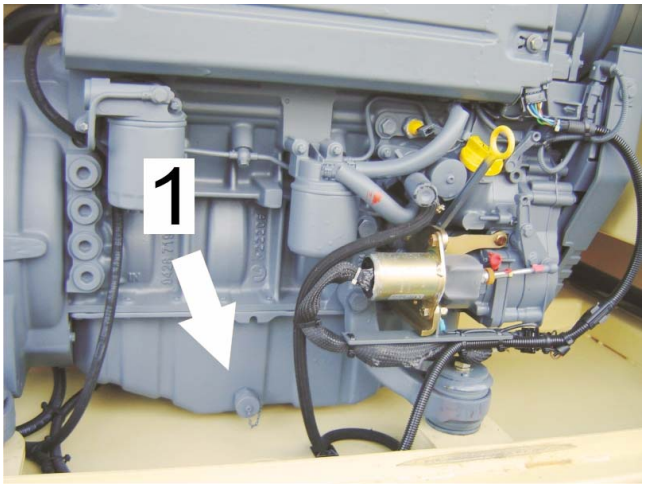
- Lube Points - 41 Grease Fittings
- Capacity - As Required
- Lube - MPG
- Interval - As Required

2. Outrigger Cylinders

- Lube Points - 4 Grease Fittings
- Capacity - As Required
- Lube - MPG
- Interval - As Required

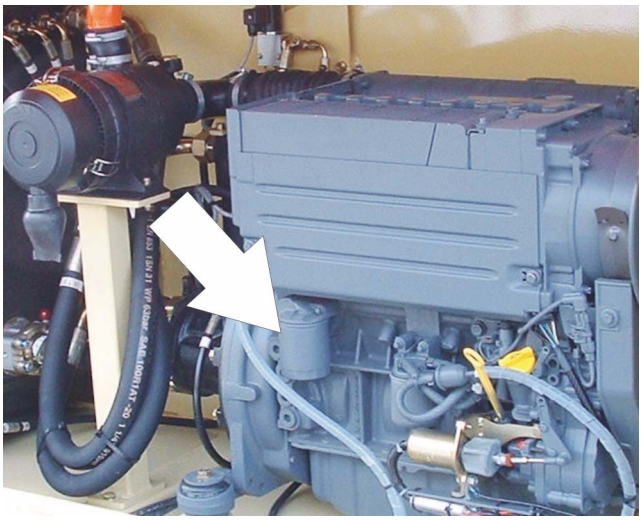
3. Engine Compartment
   a. Engine Oil Check/Fill





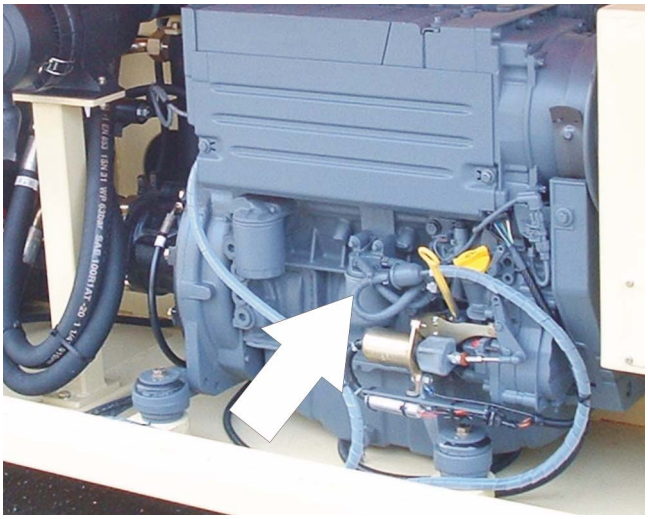
- Lube Points - Fill Cap & Dip Stick
- Capacity - See Engine Manual
- Lube - EO SAE 20W20
- Interval - Every 3 months or 150 hours of operation
- Oil Drain Plug (1)

b. Oil Filter



- Maintenance - Replaceable Element (JLG P/N 7016331)
- Interval - Change every 500 hours or 6 months, whichever comes first. Change filter every time engine oil is changed.

c. Fuel Filter



- Maintenance - Replaceable Element (JLG P/N 7020023)
- Interval - Change every year or 600 hours of operation, whichever comes first.

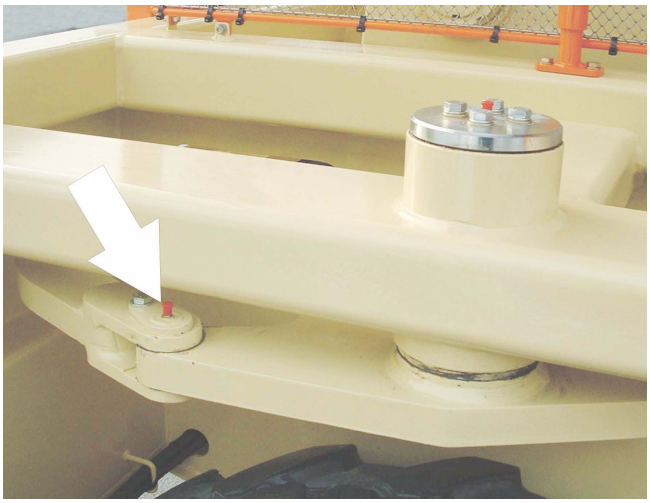
d. Air Filter

- Maintenance - Replaceable Element (JLG P/N H005232 & 70000054)
- Interval - Every 6 months or 300 hours of operation

e. Hydraulic Oil Check/Fill

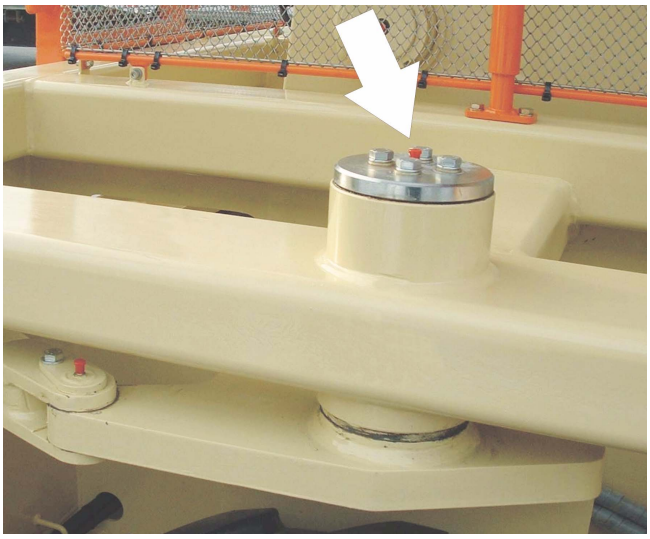
- Lube Points - Fill Cap & Site Gauge
- Capacity - 68.7 gal (260 L)
- Lube - HO
- Interval - Check oil daily, change every 1200 hours of operation

4. Tie Rod Ends



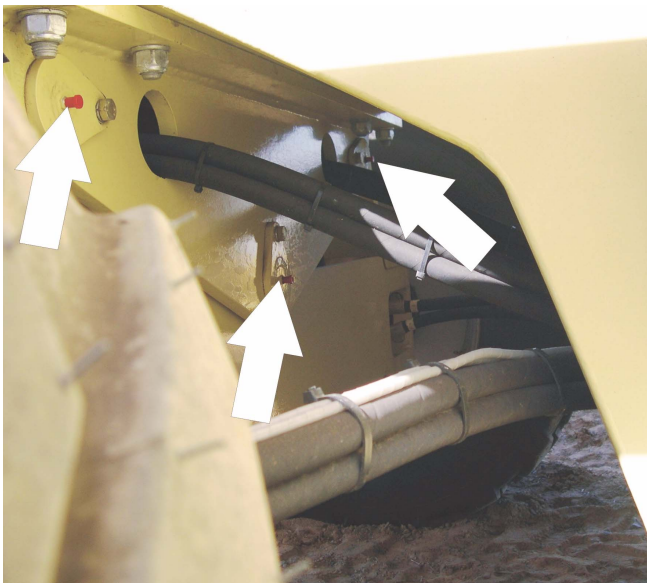
- Lube Points - 2 Grease Fittings
- Capacity - As Required
- Lube - MPG
- Interval - As Required

5. Spindles



- Lube Points - 2 Grease Fittings
- Capacity - As Required
- Lube - MPG
- Interval - As Required

6. Oscillating Axle

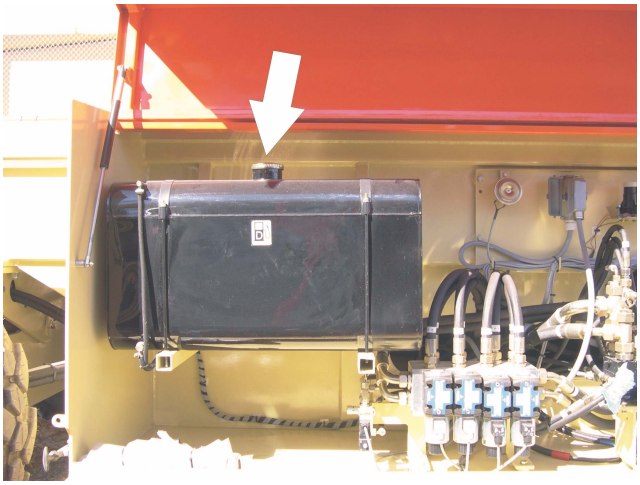


- Lube Points - 3 Grease Fittings
- Capacity - As Required
- Lube - MPG
- Interval - As Required

7. Lift Cylinder

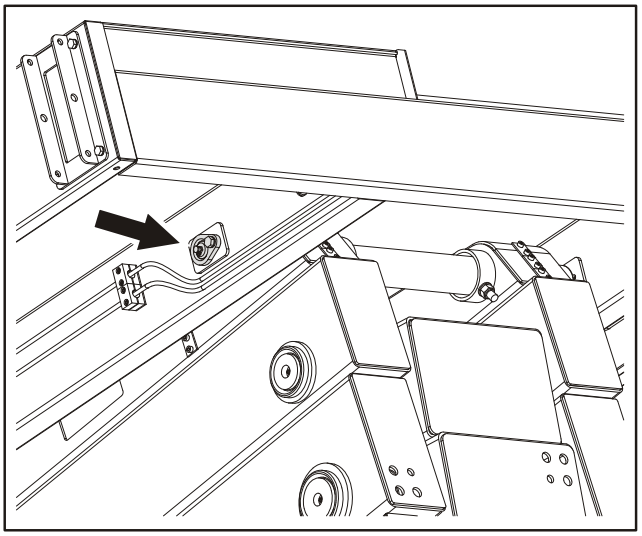
- Lube Points - 2 Grease Fittings
- Capacity - As Required
- Lube - MPG
- Interval - As Required

8. Fuel Tank (Opposite Engine Compartment)



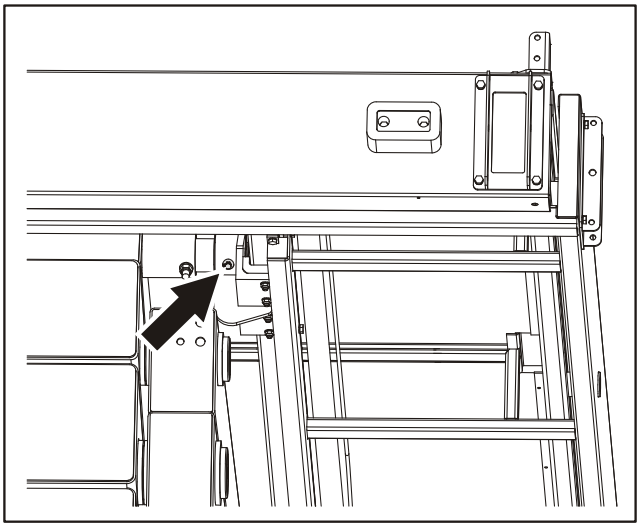
- Capacity - 23.8 gal (90 L)
- Lube - Diesel Fuel
- Interval - Check fuel periodically during each shift

9. Deck/Arm Pivot Pin



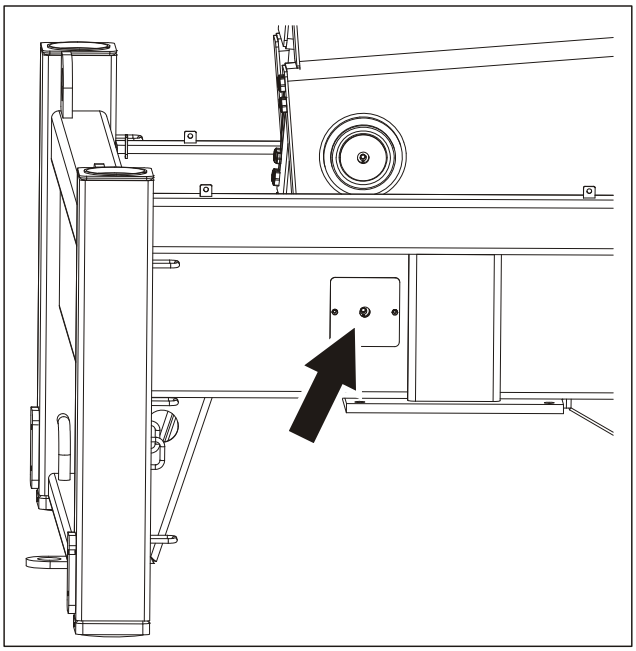
- Lube Points - 2 Grease Fittings
- Capacity - As Required
- Lube - MPG
- Interval - As Required

10. Upper Slide Pads



- Lube Points - 2 Grease Fittings
- Capacity - As Required
- Lube - MPG
- Interval - As Required

11. Lower Slide Pads



- Lube Points - 2 Grease Fittings
- Capacity - As Required
- Lube - MPG
- Interval - As Required

2.5 CYLINDER DRIFT TEST

Maximum acceptable cylinder drift is to be measured using the following method.

Platform Drift

NOTE: *Test cylinder drift with machine oil at ambient temperature.*

1. Place maximum work load onto platform (Refer to Table 1-1, Operating Specifications).
2. Extend lift cylinder to achieve a platform height 3 to 5 meters from fully stowed.
3. Wipe cylinder rod clean and place a mark on the rod 50mm from the cylinder head.
4. Wait 15 minutes.
5. Measure distance of mark from head.
6. Difference (cylinder drift) must not exceed 3mm.

NOTE: *If cylinder drift exceeds 3mm, repeat test. If still greater than 3mm, check holding valve (refer to Figure 4-44., Lift/Lower Valve Block). If still greater than 3mm, replace cylinder seals (refer to Section 4.4, Cylinder Repair).*

2.6 PREVENTIVE MAINTENANCE AND INSPECTION SCHEDULE

The preventive maintenance and inspection checks are listed and defined in the following table. This table is divided into two basic parts, the “AREA” to be inspected and the “INTERVAL” at which the inspection is to take place. Under the “AREA” portion of the table, the various systems along with the components that make up that system are listed. The “INTERVAL” portion of the table is divided into five columns representing the various inspection time periods. The numbers listed within the interval column represent the applicable inspection code for which that component is to be checked.

The checks and services listed in this schedule are not intended to replace any local or regional regulations that may pertain to this type of equipment nor should the lists be considered as all inclusive. Variances in interval times may occur due to climate and/or conditions and depending on the location and use of the machine.

NOTICE

JLG INDUSTRIES REQUIRES THAT A COMPLETE ANNUAL INSPECTION BE PERFORMED IN ACCORDANCE WITH THE "ANNUAL MACHINE INSPECTION REPORT" FORM.

Forms are supplied with each new machine and are also available from JLG Customer Service. Forms must be completed and returned to JLG Industries.

NOTE: *This machine requires periodic safety and maintenance inspections by a JLG Dealer. A decal located on the frame affords a place to record (stamp) inspection dates. Notify dealer if inspection is overdue.*

The inspection and maintenance code numbers are as follows:

1. Check for proper and secure installation.
2. Check for visible damage and legibility.
3. Check for proper fluid level.
4. Check for any structural damage; cracked or broken welds; bent or warped surfaces.
5. Check for leakage.
6. Check for presence of excessive dirt or foreign material.
7. Check for proper operation and freedom of movement.
8. Check for excessive wear or damage.
9. Check for proper tightness and adjustment.
10. Drain, clean and refill.
11. Check for proper operation while pump/motor is running.
12. Check for proper lubrication.
13. Check for evidence of scratches, nicks or rust and for straightness of rod.
14. Check for condition of element; replace as necessary.
15. Check for proper inflation

Table 2-3. Preventive Maintenance and Safety Inspection

AREA	INTERVAL				
	Daily	Weekly	100 Hours (3 Months)	200 Hours (6 Months)	400 Hours (1 year)
PLATFORM					
1. Controller	1,11				
2. Switches	1,11				
3. Placards and Decals	1,2				
4. Control Tags	1,2				
5. Hoses and Cables		4,8			
6. Wear Pads				8,12	
7. Handrails and Chains	1,4				
CHASSIS					
1. Battery	3	5			
2. Hydraulic Pump	1	5			
3. Valves	1	5			
4. Hydraulic Filter	ANNUAL				
5. Hydraulic Hoses and Tubing	1	5			
6. Hydraulic Oil Tank		5		3,4	
8. Lift Cylinder	1,12	5,6,13		4	
9. Limit Switch	1,7				
10. Tilt Alarm Switch					1,7
11. Placards and Decals	1,2				
12. Wheel and Tire Assemblies	1	8,9			
13. Drive Motors		1,5,6			
14. Drive Brakes		1,6		8	
15. Drive Torque Hubs		1,3,5,6			
16. Steer Cylinder	1	5,6,13		4	
17. Steer Components	1	4,6		8	
18. Wheel Bearings				8	12
19. Scissor Arms	1,4				
20. Safety Props	1,4				
21. Sliding Wear Pads				8,12	
22. Pivot Pins/Bolts	1,4			7,8	
23. Switches, Ground Control	1,11				
24. Control Tags	1,2				
25. Frame - including doubler plate, gussets, and surrounding area	1, 4				

NOTES:

SECTION 3. CHASSIS, PLATFORM & SCISSOR ARMS

3.1 OPERATING CHARACTERISTICS

NOTICE

ANYTIME SERVICING OF ELECTRICAL OR HYDRAULIC COMPONENTS IS REQUIRED, DISCONNECT BATTERY VIA THE DISCONNECT SWITCH ON THE GROUND CONTROL PANEL AND SHUT VALVE LEVERS AT THE BASE OF THE HYDRAULIC TANK TO STOP FLOW OF HYDRAULIC FLUID.

Leveling Jacks

The machine is equipped with auto leveling jacks. The automatic self leveling system is controlled by 4 double acting cylinders mounted at each corner of the machine chassis. These cylinders incorporate pilot operated holding valves on the piston side. The cracking pressure of these valves is 15 psi (1 bar) for the rear and116 psi (8 bar) for the front.

1. Activate the leveling jack switch located on the ground control console.
2. Extend the jacks by moving the joystick on the platform control box forward.

NOTE: *The jacks deploy at idle engine speed. Once all four jacks make contact with the ground the system will go from set mode into level mode. Once level, engine rpm's will increase and lift is allowed.*

3. The tilt indicator LED's on the Main Terminal Box will go out once the machine is level.

NOTE: *There are limit switches mounted at each jack cylinder. These sense when the jack makes ground contract and enable the lift function. All four switches must have contact (lift indicator LED on the platform will light) to enable lift. When elevated, if a contact signal is lost (jack loses ground contact, wire cut, etc.), the lift function is stopped and only lowering is permitted.*
The jacks are operational (extend or retract) if the machine is in the stowed position. The minimum height limit switch must sense the machine is stowed. A failure of the limit switch will prevent the jacks from being activated.

NOTE: *Refer to Section 5.3, Nivolux - Automatic Self-Leveling System for detailed information regarding the automatic leveling system.*

3.2 WHEEL ASSEMBLY

Drive System

Wheel drive is achieved by orbital type (100cc/rev) hydraulic motors driving a wheel type gearbox (29.8:1 reduction) through a spring-applied brake. The brake is released by actuating a 3-way solenoid valve. This valve provides hydraulic power from the pump directly to the brakes. The brake resets by deactivating the valve and restricting flow to the tank through an orifice to smooth out hard stops.

Drive is controlled by 2 proportional solenoid valve sections within the main control valve. Flow to the drive motors passes through a 4-section solenoid drive valve manifold 2 for differential lock and 2 for fast drive.

There are three modes for drive selected by the drive speed select switch on the platform control console:

1. Normal Drive - 4 wheel drive
2. Differential Lock - 4 wheel drive with flow dividers
3. Fast Drive - 2 wheel drive

Normal Drive:

Flow passes from section 9 to the front drive section of the drive valve (ports A1 & B1) and from section 2 to the rear section of the drive valve ports (A2 & B2).

All 4 solenoids on the drive valve are in the passive (non-energized) mode. Flow from A/B1 passes directly to the front drive motor ports (C/D1 & C/D2) and from A/B2 to the rear drive motors (C/D3 & C/D4).

Differential Lock:

As in normal drive, flow passes from section 9 to the front drive section of the drive valve (ports A1 & B1) and from section 2 to the rear section of the drive valve ports (A2 & B2).

The 2 differential lock solenoids are energized which directs the flow through 2 flow dividers in the drive valve. These split the flow to the left and right front motors (1 & 2) and to the rear motors (3 & 4).

Fast Drive:

Valve section 2 is not used in fast drive. Flow from section 9 passes to the front section of the drive valve. The 2 fast drive solenoids are energized which connect the ports of the rear drive motors (C3 to D3) and (C4 to D4). This allows the rear drive motors to free wheel.

Drive Hub

NOTICE

DRIVE HUB UNITS SHOULD ALWAYS BE ROLL AND LEAK TESTED BEFORE DISASSEMBLY AND AFTER ASSEMBLY TO MAKE SURE THAT THE UNIT'S GEARS AND SEALANTS ARE WORKING PROPERLY.

The following information briefly outlines what to look for when performing these tests.

⚠ WARNING

IF THE MACHINE IS ON ANY INCLINE, THE WHEELS MUST BE ADEQUATELY BLOCKED PRIOR TO MANUALLY DISENGAGING THE BRAKES. FAILURE TO DO SO MAY RESULT IN INJURY OR EVEN DEATH.

Roll Test

The purpose of the roll test is to determine if the unit's gears are rotating freely and properly. You should be able to rotate the wheel or hub of the gearbox by hand. If you feel more drag in the gears only at certain points, then the gears are not rolling freely and should be examined for improper installation or defects. Some gear packages roll with more difficulty than others. Do not be concerned if the gears in your unit seem to roll hard as long as they roll with consistency.

Leak Test

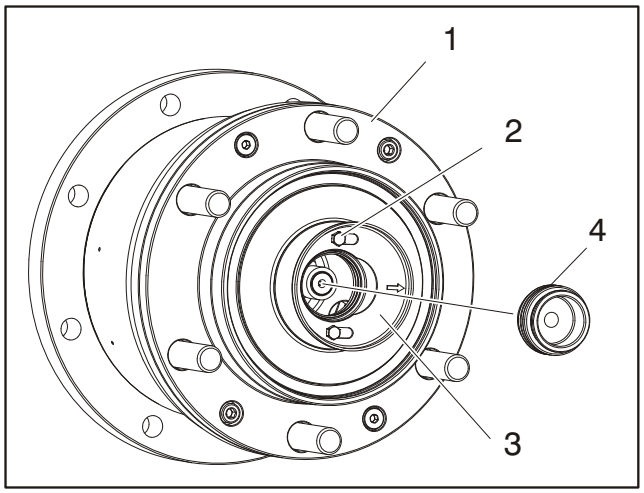
The purpose of a leak test is to make sure the unit is air tight. You can tell if your unit has a leak if the pressure gauge reading on your leak checking fitting starts to fall after the unit has been pressurized and allowed to equalize. Leaks will most likely occur at the pipe plugs, the main seal or wherever o-rings are located. The exact location of a leak can usually be detected by brushing a soap and water solution around the main seal and where the o-rings or gaskets meet on the exterior of the unit, then checking for air bubbles. If a leak is detected in a seal, o-ring or gasket, the part must be replaced, and the unit rechecked. Leak test at **10 psi** for 20 minutes.

NOTE: *Due to the small air volume inside this Torque-Hub, it will pressurize to 10 psi very quickly. If the pressure becomes excessive in the unit the seals will be destroyed.*

Lubricant

The torque hub unit is shipped with 90W gear oil. It is designed to utilize the same oil throughout its service life. However, should it need to be serviced the oil will need to be drained and replaced.

In the event of servicing, fill the unit with Arco H.D. 120# Drum or Exxon GX 80W-90.



1. Drive Hub
2. Screw
3. Circlip
4. Pin

Figure 3-1. Torque Hub

Hub Disengaging and Oil Checking Procedure:

1. Loosen the two Screws (2) securing the Circlip (3).
2. Slide the Circlip (3) in the direction of the arrow.
3. Remove the Pin (4).
4. The proper gear oil level should be to the base of the opening. Add gear oil if needed.
5. Turn the Pin (4) around and place back onto Hub (1).

NOTE: *Side of Pin that was facing outside should now be facing the inside of the hub.*

6. Slide Circlip (3) in opposite direction of arrow to secure the Pin. Tighten Screws (2) to secure the Circlip in place.

Table 3-1. Torque Hub Technical Specifications

Max Torque	5.5 kNm
Max Input Speed	4000 rpm
Weight	101.4 lbs (46 kg)
Brake	
Static Torque	147.5 lb ft (200 Nm)
Releasing Pressure	174-217.5 psi (12-15 bar)
Max Pressure	1450.3 psi (100 bar)
Max Input Torque	147.5 lb ft (200 Nm)

Tire Replacement

JLG recommends a replacement tire be the same size, ply and brand as originally installed on the machine. Please refer to the JLG Parts Manual for the part number of the approved tires for a particular machine and model. If not using a JLG approved replacement tire, it is recommended that replacement tires have the following characteristics:

- Equal or greater ply/load rating and size of original
- Tire tread contact width equal or greater than original
- Wheel diameter, width, and offset dimensions equal to the original

Unless specifically approved by JLG Industries, Inc. do not replace a foam filled tire assembly with a pneumatic tire. When selecting and installing a replacement tire, ensure that all tires are inflated to the pressure recommended by JLG. Due to size variations between tire brands, both tires on the same axle should be the same.

NOTE: *Tires are foam filled to 108.8 psi (7.5 bar).*

Wheel Replacement

The rims installed on each product model have been designed for stability requirements which consist of track width, tire pressure, and load capacity. Size changes such as rim width, center piece location, larger or smaller diameter, etc., without written factory recommendations, may result in an unsafe condition regarding stability.

Wheel Installation

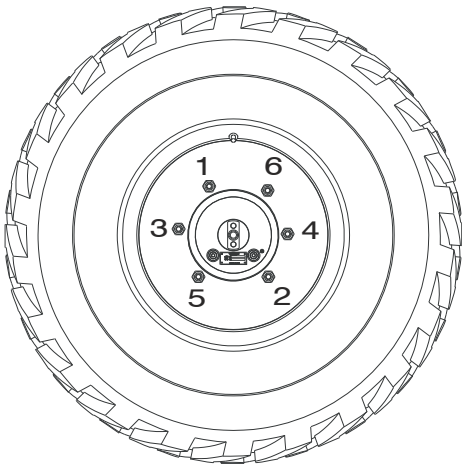
It is extremely important to apply and maintain proper wheel mounting torque.

⚠ WARNING

WHEEL NUTS MUST BE INSTALLED AND MAINTAINED AT THE PROPER TORQUE TO PREVENT LOOSE WHEELS, BROKEN STUDS, AND POSSIBLE DANGEROUS SEPARATION OF WHEEL FROM THE AXLE. BE SURE TO USE ONLY THE NUTS MATCHED TO THE CONE ANGLE OF THE WHEEL.

Tighten the lug nuts to the proper torque to prevent wheels from coming loose. Use a torque wrench to tighten the fasteners. If you do not have a torque wrench, tighten the fasteners with a lug wrench, then immediately have a service garage or dealer tighten the lug nuts to the proper torque. Over-tightening will result in breaking the studs or permanently deforming the mounting stud holes in the wheels. The proper procedure for attaching wheels is as follows:

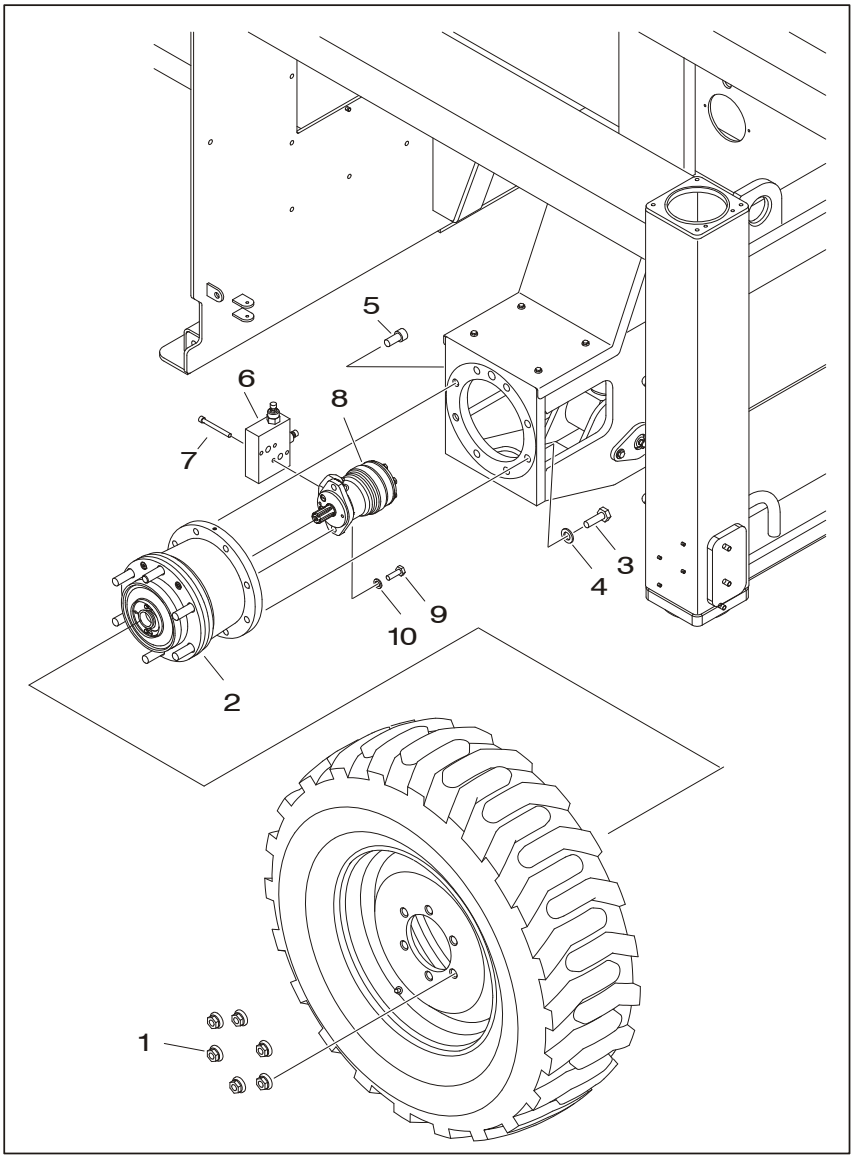
1. Start all nuts by hand to prevent cross threading. **DO NOT** use a lubricant on threads or nuts.
2. Tighten nuts in the following sequence:



3. The tightening of the nuts should be done in stages. Following the recommended sequence, tighten the nuts per wheel torque chart.

TORQUE SEQUENCE		
1st Stage	2nd Stage	3rd Stage
150-190 lb ft (210 - 270 Nm)	230 - 270 lb ft (320-380 Nm)	305 - 343 lb ft (440 - 480 Nm)

4. Wheel nuts should be torqued after the first 50 hours of operation and after each wheel removal. Check torque every 3 months or 150 hours of operation.



1. Wheel Nut (6 per tire)
2. Drive Hub
3. Bolt, M16 x 55mm (6 per wheel)
4. Flatwasher, M16 (6 per wheel)
5. Capscrew, M16 x 35mm (2 per wheel)
6. Double Shock Valve (Rear Wheels)

   Travel Brake Valve (Front Wheels) (Not Shown)
7. Capscrew, M10 x 45mm (Rear) (4 per valve)

   Capscrew, M10 x 55mm (Front) (Not Shown) (4 per valve)

8 Drive Motor

9 Bolt, M12 x 35mm (2 per motor)

10 Lockwasher, M12 (2 per motor)

Figure 3-2. Wheel Assembly Removal

⚠ WARNING

SECURE MACHINE WITH JACKS AND CHALK BLOCKS WHEN REMOVING AND/OR INSTALLING WHEELS.

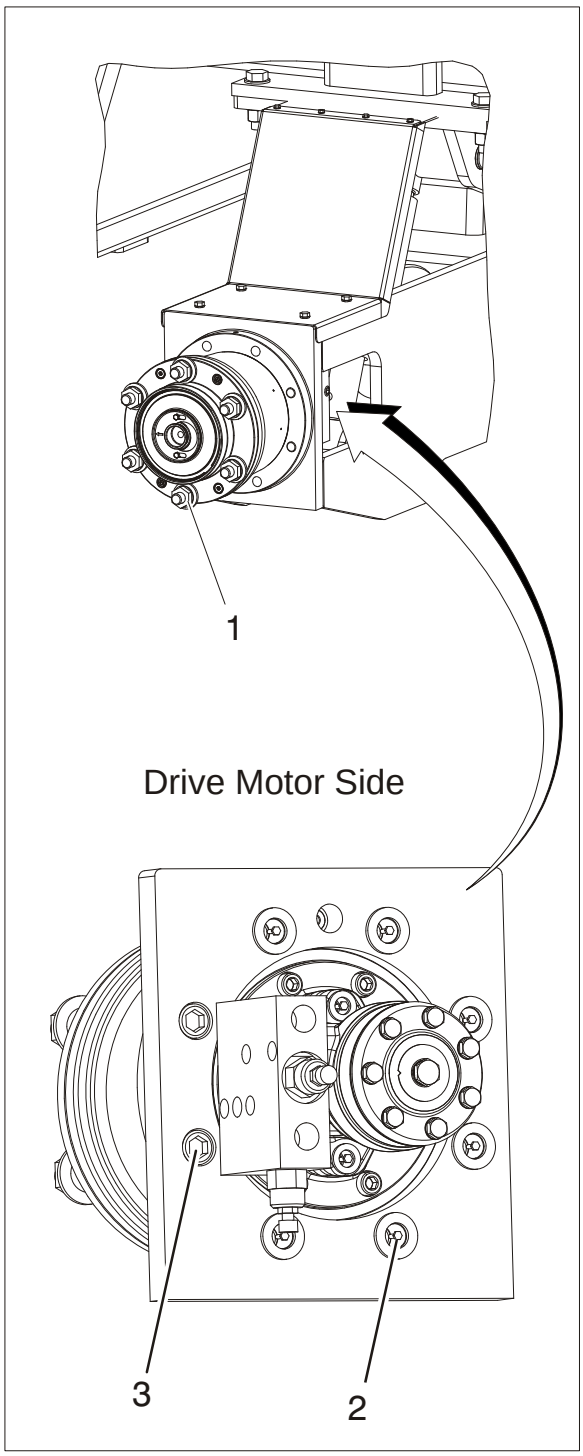
NOTE: *Follow these steps when servicing/replacing the wheel/tire assembly.*

Removal

1. Elevate machine with jacks or other suitable device and secure.
1. Remove 6 Wheelnuts (1).
2. Carefully remove tire from Drive Hub (2).
3. Disconnect all hoses/wires from Drive Motor (5).
4. Unscrew Capsrews (7) on Valve (6) and carefully remove valve.
5. Remove two Bolts (6) and Lockwashers (7) attaching the Drive Motor to the Drive Hub. Carefully remove the Drive Motor.
6. Remove the eight Bolts (3) and Flatwashers (4) attaching the Drive Hub to the Spindle (8). Carefully remove the Drive Hub.

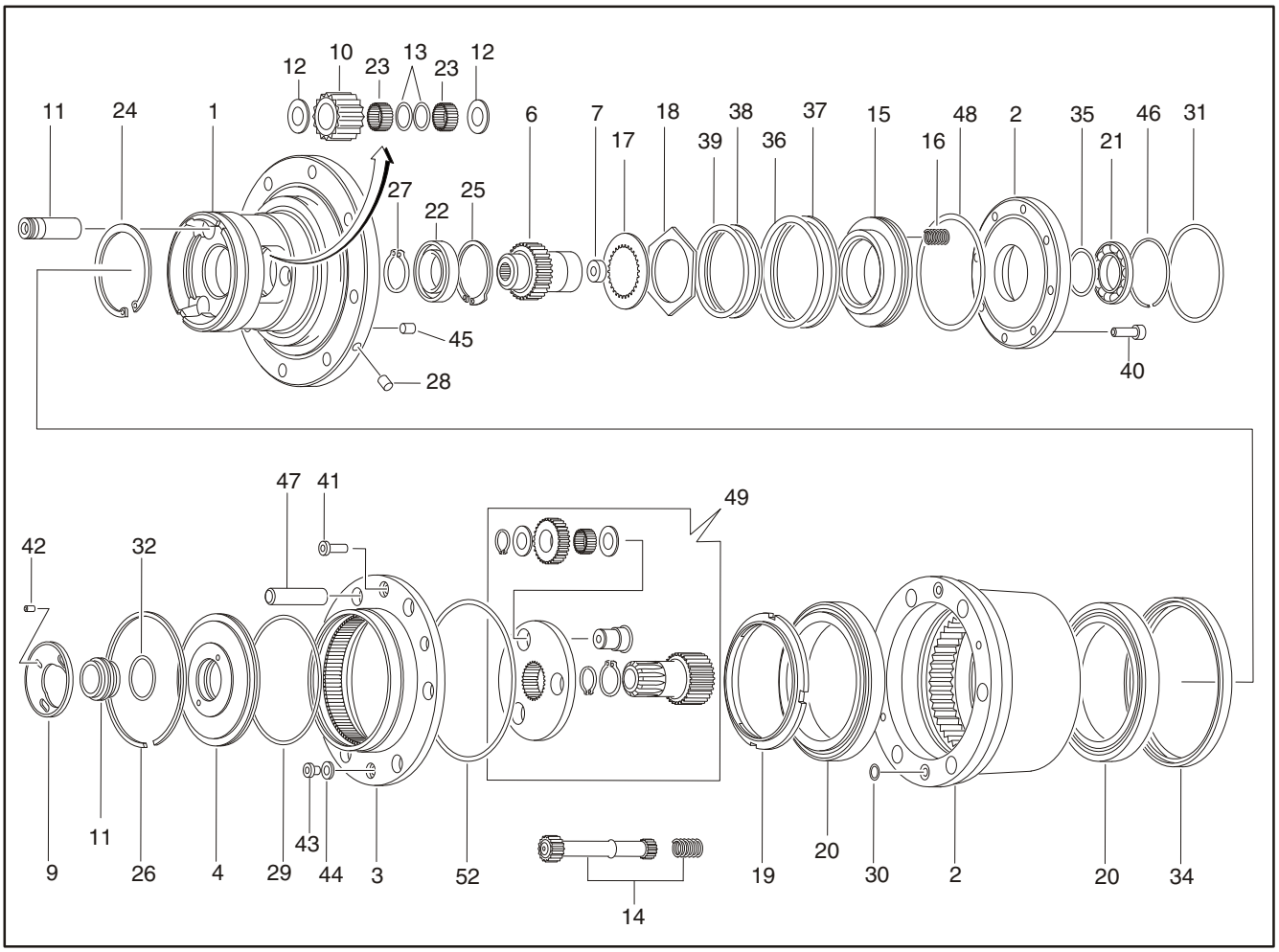
Installation

- Follow the removal steps in reverse order when installing the wheel assembly.



1. Torque to 354 lb ft Dry (480 Nm)
2. Torque to 230.9 lb ft Dry (313 Nm)
3. Torque to 230.9 lb ft Dry (313 Nm)

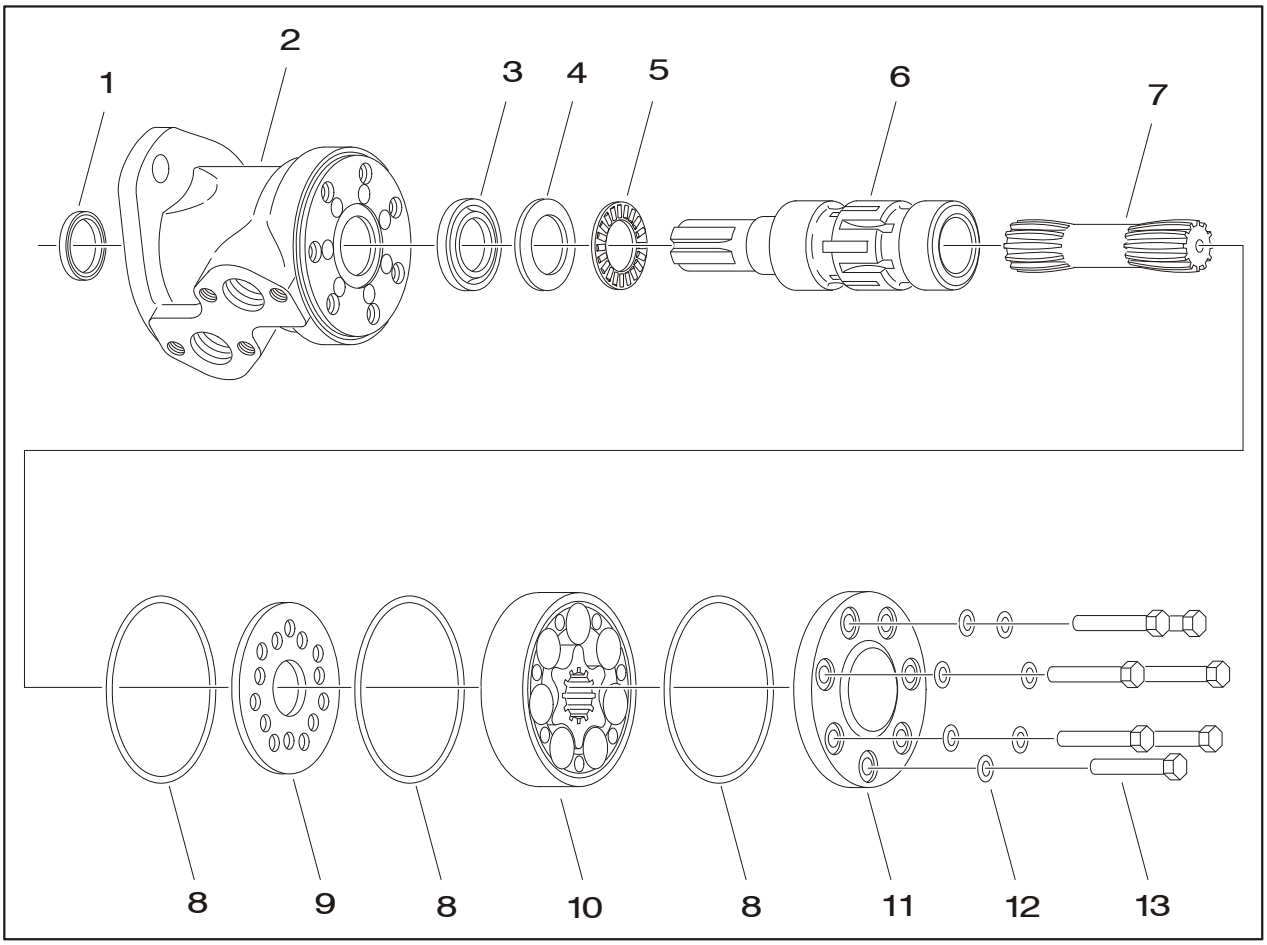
Figure 3-3. Hub Torque Values



1. Spindle	14. Sun Pinion	27. Circlip	40. Screw
2. Hub	15. Piston	28. Plug	41. Screw
3. Gear Ring	16. Spring	29. O-Ring	42. Screw
4. Cover	17. Disc	30. O-Ring	43. Plug
5. Flange	18. Disc	31. O-Ring	44. Washer
6. Coupling	19. Lock Nut	32. O-Ring	45. Plug
7. Thrust Washer	20. Bearing	33. O-Ring	46. Disc
8. Thrust Washer	21. Bearing	34. Oil Seal	47. Threaded Stud
9. Circlip	22. Bearing	35. Gasket	48. O-Ring
10. Planetary Gear	23. Bearing	36. O-Ring	49. Reduction Gear Kit
11. Pin	24. Circlip	37. Blocking Ring	
12. Thrust Washer	25. Circlip	38. O-Ring	
13. Spacer	26. Disc	39. Blocking Ring	

Figure 3-4. Torque Hub Assembly

3.3 DRIVE MOTOR



1. Dust Seal
2. Motor Housing
3. Shaft Seal
4. Bearing Race
5. Axel Needle Bearing
6. Output Shaft
7. Cardan Shaft
8. O-Ring
9. Distributor Plate
10. Gear Wheel Set
11. End Cover
12. Washer
13. Screw

Figure 3-5. Drive Motor (OMR 100)

Table 3-2. Drive Motor Specs

Displacement	99.8 cm^3
Max Speed	600 rpm
Max Torque	177 lb ft (240 Nm)
Max Power	13 kw
Max Oil Flow	15.9 gal/min (60 L/min)

Motor Disassembly

NOTE: *For numbers in ( ), refer to Figure 3-5., Drive Motor (OMR 100).*

1. Place the Motor Housing (2) in a holding tool with the flange upwards.
2. Use a 13mm spanner socket to remove the screws (13) and washers (12).
3. Remove the End Cover (11) sideways.
4. When removing the Gear Wheel Set (10) and two O-Rings (8), keep fingers under the the gear wheel set to prevent the parts from falling out.
5. Remove the Cardan Shaft (7).
6. Remove the Distributor Plate (9) and O-Ring (8).
7. To remove the Output Shaft (6), place the motor housing (2) on a work bench and press the shaft out of the motor housing.
8. Remove the Bearing Race (4) from the motor housing (2).
9. Remove the Axel Needle Bearing (5).
10. With a mandrel and plastic hammer, carefully knock out the Shaft Seal (3) and Dust Seal Ring (1).

NOTE: *When cleaning parts, clean parts carefully with low aromatic kerosine.*

Check all parts carefully and replace if necessary.

Before assembly, lubricate all parts with hydraulic oil and grease rubber parts with vaseline.

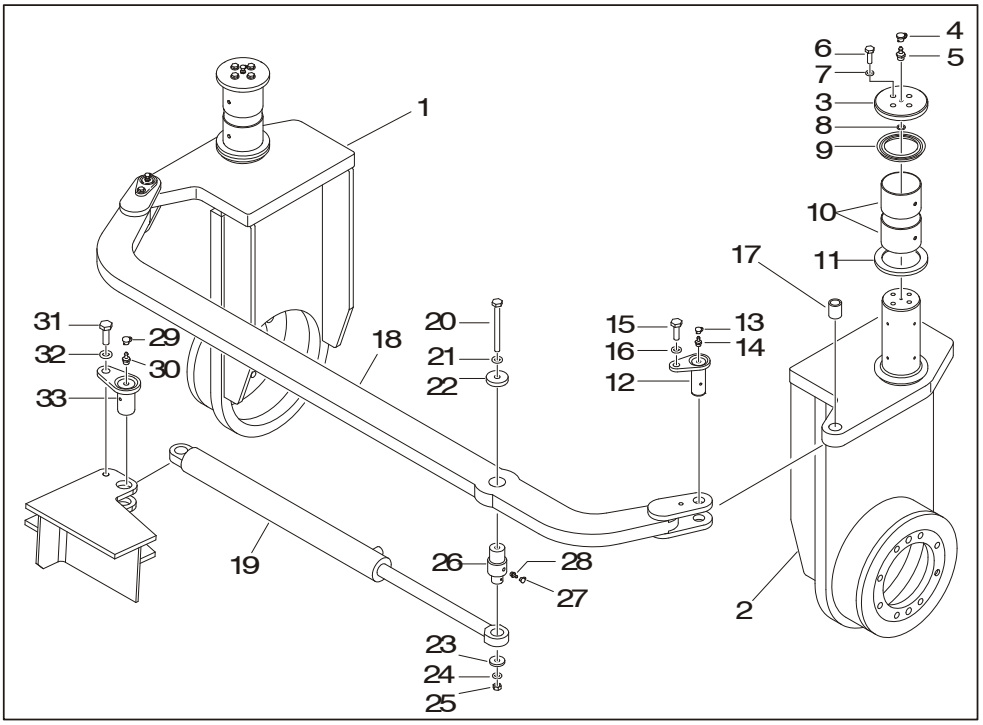
Motor Assembly

1. Place the Motor Housing (2) in a holding tool with the flange upwards.
2. Lubricate the Shaft Seal (3) on the outside with hydraulic oil. Fit the shaft seal correctly onto the mandrel and carefully press the shaft seal into position into the motor housing.
3. Place the Dust Seal Ring (1) in the spigot flange and knock it into position with a plastic hammer and appropriate mandrel.
4. Fit the Bearing Race (4) onto the shaft and mount together with the shaft.
5. Place the Axel Needle Bearing (5) back onto shaft.
6. Output Shaft (6): Grease the journals with hydraulic oil. The rear shaft end must be marked before fitted. The mark must be positioned vertically above a commutation slot leading up to the front annular channel.
7. Grease the O-Ring (8) and put it in the O-ring groove of the housing.
8. Turn the Distributor Plate (9) so that the holes iine up.
9. Guide the Cardan Shaft (7) down into the motor housing. In case of different splines lengths turn the cardan shaft to ensure the long splines end is fitted in the output shaft. Transfer marking from output shaft to cardan shaft.
10. Place the two O-Rings (8) (greased) in the O-ring grooves of the Gearwheel. In gearwheels with non through splines place the gearwheel with the recess in the spline hole facing down towards the housing. Place the Gear Wheel Set (10) on the cardan shaft so that the top of a tooth in the external teeth of the gearwheel are vertically above the mark on the cardan shaft. Turn the gearwheel set counterclockwise until the cardan shaft and the gearwheel start to mesh (15°). Turn the gearwheel rim so that the holes made for the screws line up.
11. Turn the End Cover (11) so that the holes line up.
12. Place the Washers (12) onto the Screws (13). Use a 13mm spanner socket to tighten the screws.

Table 3-3. Tightening Torques

Item	Torque
Screws (item 13 in Figure 3-5.)	270 - 315 lbf in (3.0 - 3.5 daNm)
Plug (if applicable) (not shown)	445 - 620 lbf in (5 - 7 daNm)

3.4 STEERING ASSEMBLY



1. Right Spindle
2. Left Spindle
3. Cap
4. Grease Fitting Cap
5. Grease Fitting
6. Bolt, M12 x 30mm
7. Lockwasher, M12
8. O-Ring
9. Ring
10. Bushing*
11. Ring
12. Pin
13. Grease Fitting Cap
14. Grease Fitting
15. Bolt, M12 x 20mm
16. Lockwasher, M12
17. Bushing
18. Tie Bar
19. Steer Cylinder
20. Bolt, M12 x 150mm
21. Flatwasher, M12
22. Washer
23. Washer
24. Flatwasher, M12
25. Nut, M12
26. Pin
27. Grease Fitting Cap
28. Grease Fitting
29. Grease Fitting Cap
30. Grease Fitting
31. Bolt, M12 x 20mm
32. Lockwasher, M12
33. Pin

Figure 3-6. Steering Assembly

NOTE: ** = not used on later machines.*

Remove wheel and tire assemblies before attempting to service the steering assembly. Disconnect electrical supply and any wires and/or hoses. Secure machine with proper stabilizing devices.

Removal

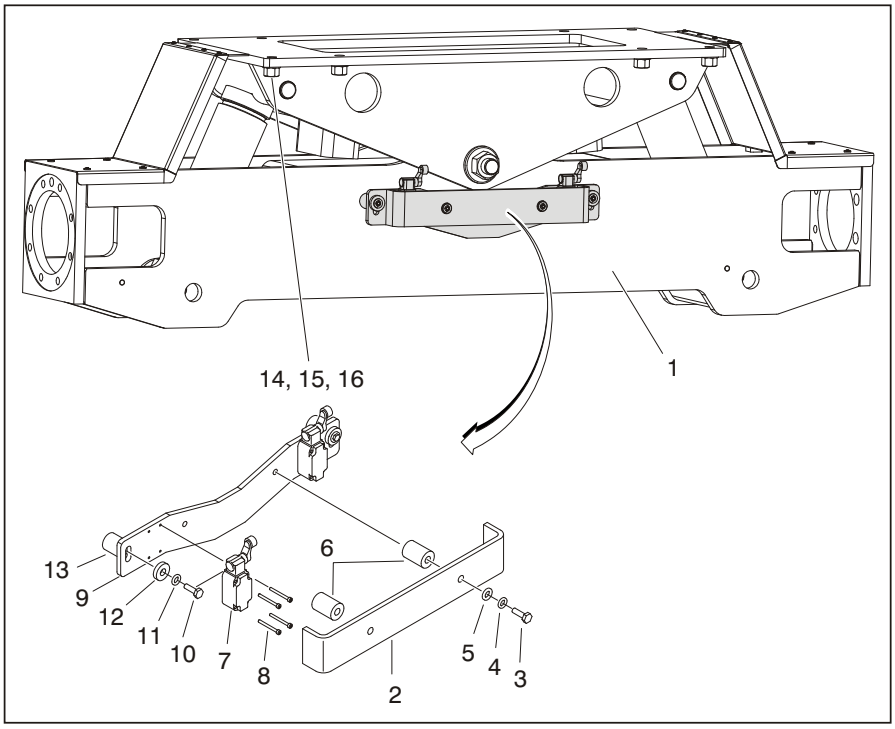
1. Remove Steer Cylinder (19) by removing Bolts (20, 31), Washers (21, 22, 23, 32), Nuts (25) and Pins (26, 33).
2. Disconnect Tie Bar (18) from both Spindles (1, 2) by removing Bolts (15), Lockwashers (16), Pins (12), and Bushings (17). Remove Tie Bar.
3. Spindles can now be removed from the chassis. Secure Spindle. Remove Grease Cap (4) and Fitting (5). Remove Bolts (6), Lockwashers (7), Cap (3), O-Ring (8), Ring (9), and Bushings* (10). The Spindle can now be removed for repair/replacement.

Installation

1. Follow the Removal Steps in reverse order when assembling the steering system.

3.5 REAR AXLE

Limit Switches



1. Rear Axle
2. Limit Switch Cover
3. Bolt, M12 x 70mm
4. Flatwasher, M12
5. Lockwasher, M12
6. Bushing
7. Limit Switch
8. Capscrews, M5 x 50mm
9. Plate
10. Bolt, M12 x 80mm
11. Lockwasher, M12
12. Bushing
13. Bushing
14. Capscrew, M20 x 80mm
15. Hardened Washer, 20mm
16. Nut, M20

Figure 3-7. Oscillating Axle Limit Switches

NOTE: *Limit switches are located on the front side of the rear axle.*

Follow the below procedures when removing and/or replacing limit switches.

Removal:

1. Disconnect battery by turning the handle on the ground control panel.
2. Remove the Limit Switch Cover (2) and Bushings (6) by unscrewing and removing the two Bolts (3), Flatwashers (4), and Lockwashers (5).
3. The Limit Switches (7) can now be removed. Unscrew the four Capscrews (8) at each corner of the limit switch. Disconnect any electrical wires. Remove limit switch from Plate (9).
4. The Plate can be removed from the Axle (1) by unscrewing and removing the two Bolts (10), Lockwashers (11), and Bushings (12 and 13).

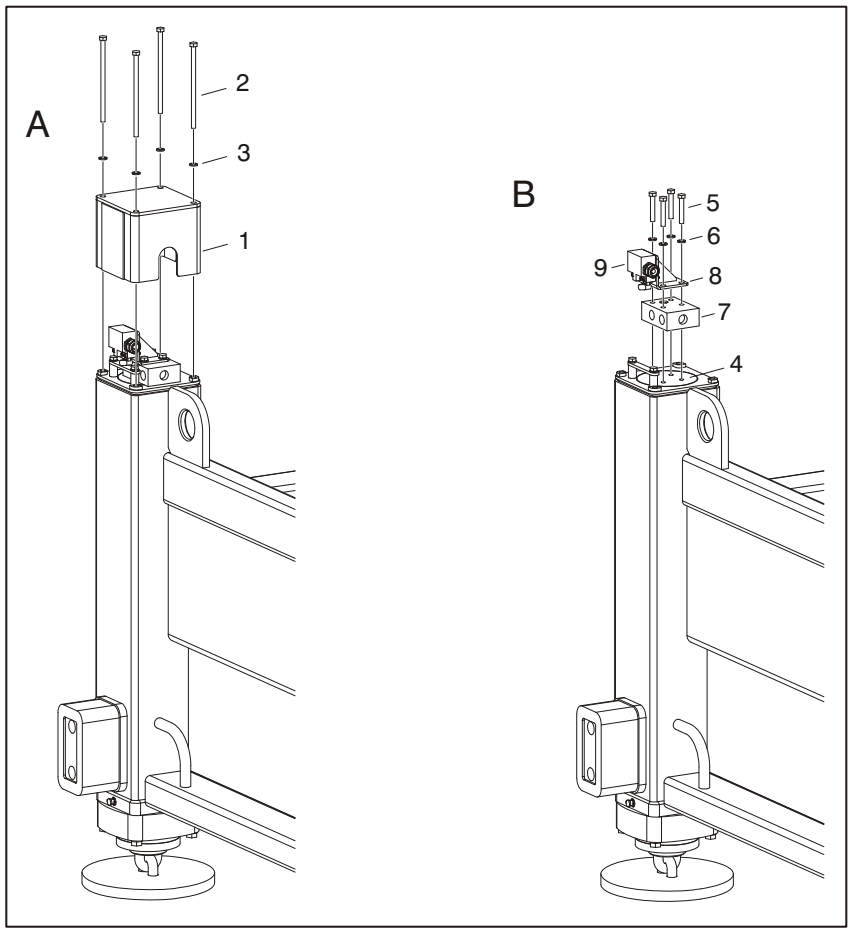
Installation:

1. Follow the removal steps in reverse order when installing the limit switches and/or any of the components.
2. Limit Switch Adjustment:
   a. Adjust limit switches to trip when axle is oscillated 1°.

Axle Removal:

1. Secure the machine and the axle.
2. Remove the eight Capscrews (14), Hardened Washers (15), and Nuts (16). Carefully remove the axle from the chassis.
3. When installing the axle, torque the Capscrews (14) to 450 lb ft (610 Nm) dry.

3.6 OUTRIGGER CYLINDER REMOVAL



1. Cover
2. Bolt, M8 x 160mm
3. Lockwasher, M8
4. Outrigger Cylinder
5. Bolt, M8 x 50mm
6. Lockwasher, M8
7. Valve Assembly
8. Limit Switch Bracket
9. Limit Switch

Figure 3-8. Outrigger Cylinder Removal - (Sheet 1 of 2)

NOTE: *Refer to Figure 3-8., Outrigger Cylinder Removal - (Sheet 1 of 2) and Figure 3-9., Outrigger Cylinder Removal - (Sheet 2 of 2).*

Shut off flow of hydraulic oil before attempting to remove any outrigger cylinder.

Removal:

A)

1. Remove the Cover (1) by removing the four Bolts (2) and Lockwashers (3).

B)

2. Disconnect all hydraulic hoses and wires attached to the Valve Assembly (7) and Limit Switch (9).
3. Remove the Valve Assembly, Limit Switch Bracket (8) and Limit Switch from the top of Outrigger Cylinder (4)by removing the four Bolts (5) and Lockwashers (6).

NOTE: *Support cylinder rod to prevent rod extension and consequential oil spillage.*

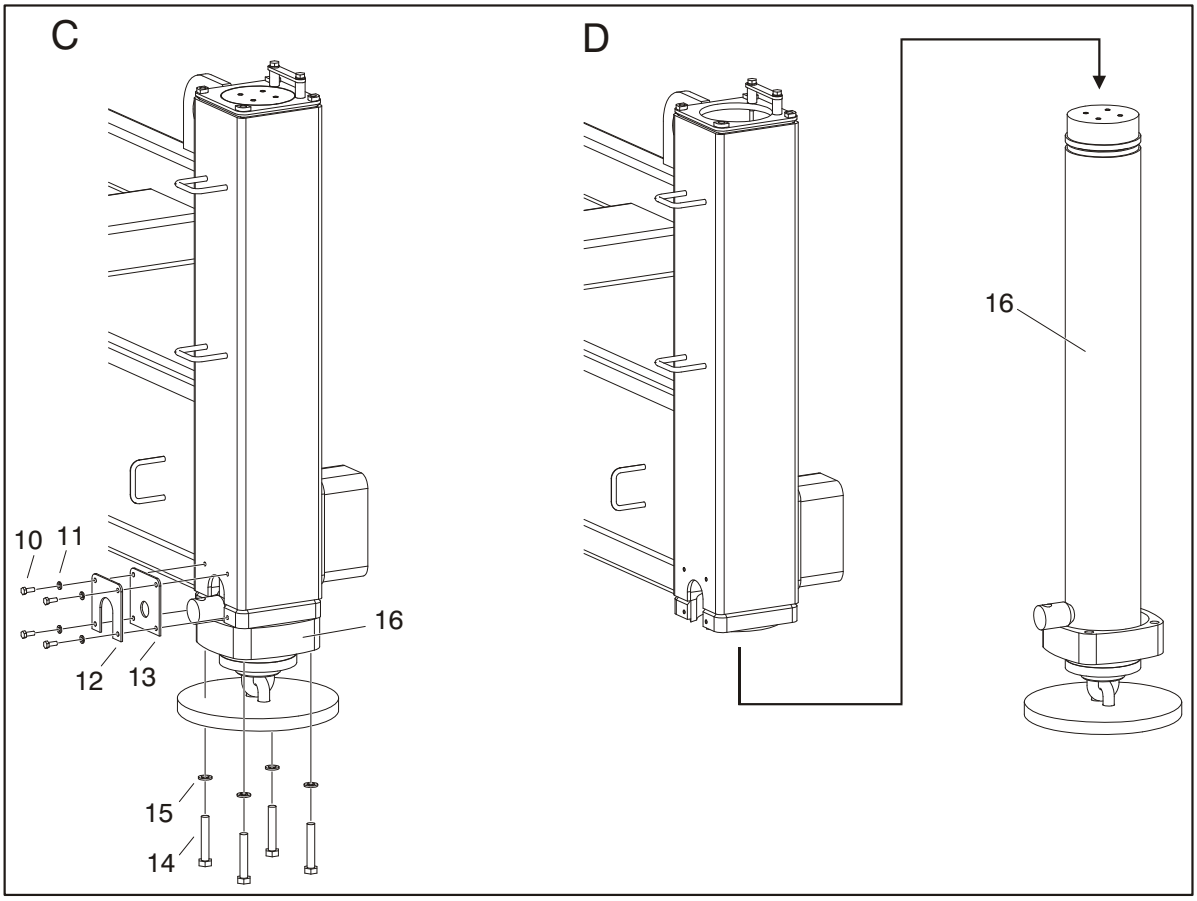
After "Removal Step #3," the frame must be elevated greater than the length of the stowed outrigger cylinder to remove the cylinder.

C)

4. Remove the Plate (12) and Gasket (13) by removing the four Bolts (10) and Lockwashers (11).
5. Secure the Outrigger Cylinder (16). Remove the four Bolts (14) and Lockwashers (15) attaching the cylinder to the frame.

D)

6. Carefully lower the Cylinder out of the frame.



10. Bolt, M6 x 16mm
11. Lockwasher, M6
12. Plate
13. Gasket
14. Bolt, M12 x 70mm
15. Lockwasher, M12
16. Outrigger Cylinder

Figure 3-9. Outrigger Cylinder Removal - (Sheet 2 of 2)

Installation:

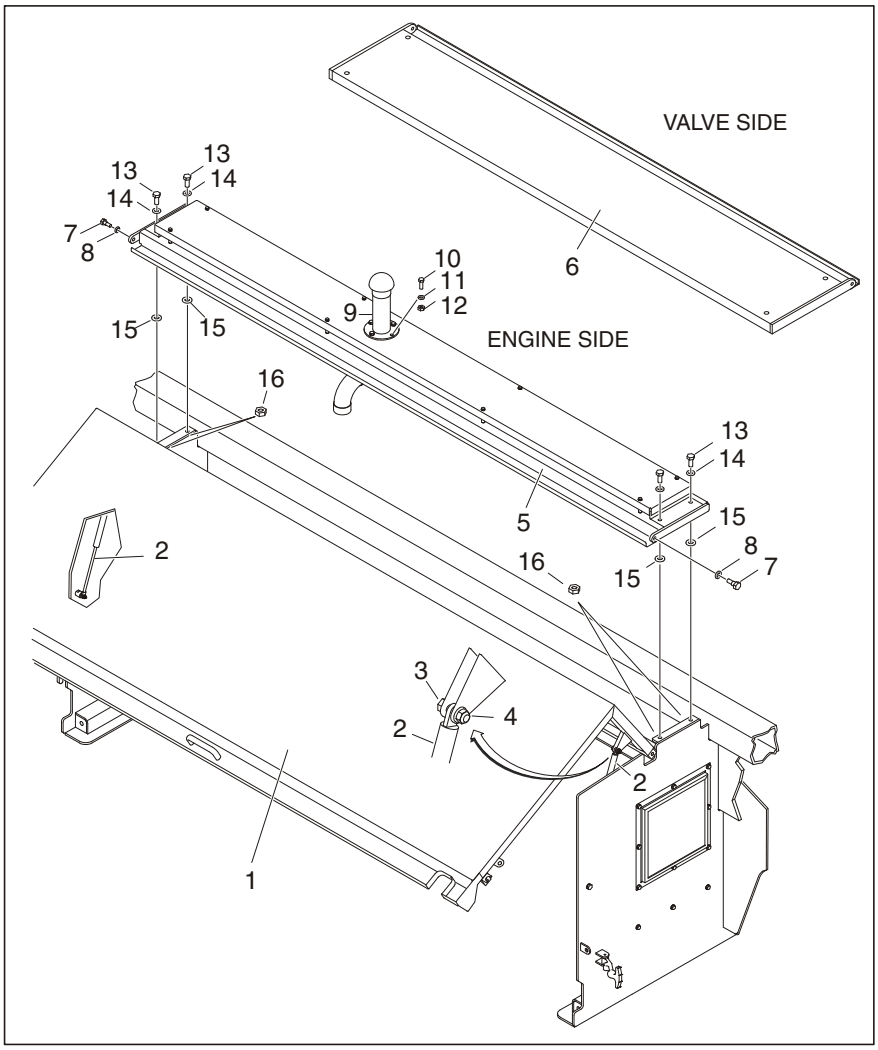
1. Carefully insert Outrigger Cylinder (16) back into the frame and secure with the four Bolts (14) and Lockwashers (15).
2. Replace Gasket (13) and Plate (12). Secure with four Bolts (10) and Lockwashers (11).

NOTE: *At this point the frame may be lowered.*

3. Place Valve Assembly (7), Limit Switch Bracket (8), and Limit Switch (9) back onto the top of the cylinder and secure with the four Bolts (5) and Lockwashers (6).
4. Reconnect all hydraulic lines and electrical wires.
5. Return flow of hydraulic oil and ensure there is no leakage. Operate cylinder to ensure it works properly.
6. Replace Cover (1) and secure with four Bolts (2) and Lockwashers (3).

3.7 ENGINE COMPARTMENT

Hood Assembly



1. Hood
2. Gas Spring
3. Bolt, M8 x 30mm
4. Nut, M8
5. Cabinet Top Panel (Left)
6. Cabinet Panel (Right)
7. Special Bolt
8. Flatwasher, M12
9. Air Intake Pipe
10. Bolt, M8 x 25mm
11. Flatwasher, M8
12. Locknut, M8
13. Bolt, M10 x 30mm
14. Nut, M10
15. Flatwasher, M10
16. Nut, M10

Figure 3-10. Hood Assembly

NOTE: *Removing the hoods will allow for easier access to the components inside the engine compartment and valve compartment.*

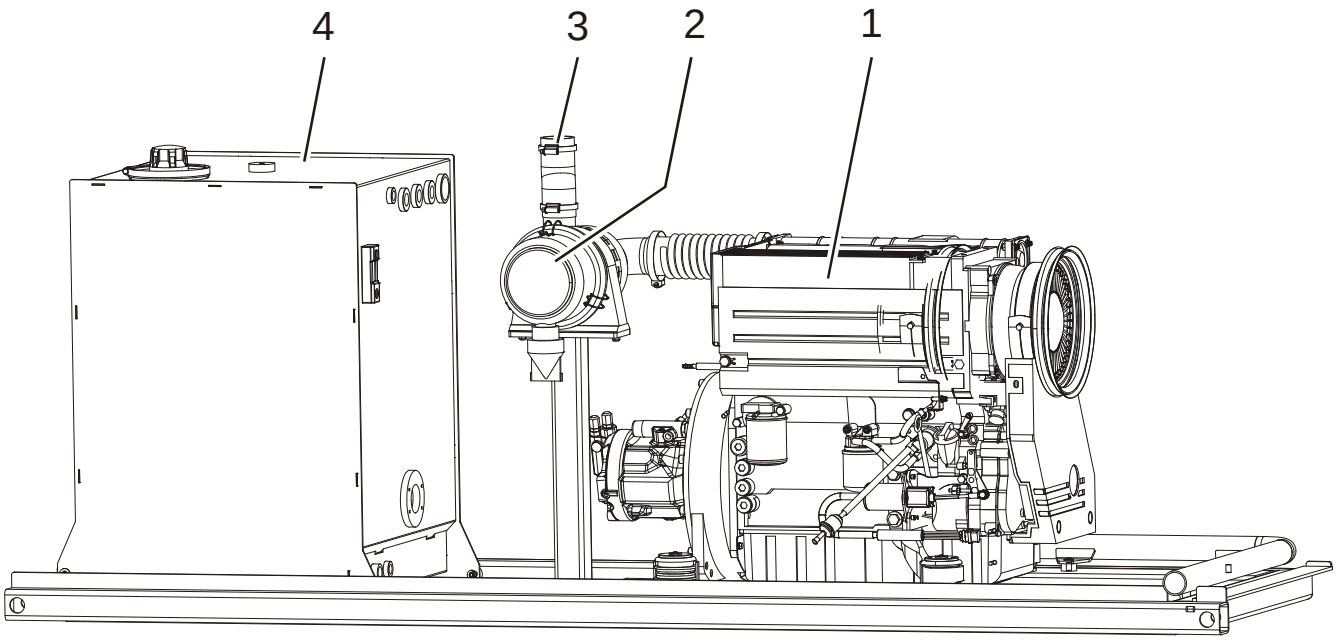
1. Open and secure Hood (1).
2. Remove Bolt (3) and Nut (4) on both Gas Springs (2). Return Hood to closed position.
3. Remove both Bolts (7) and Flatwashers (8) connecting hoods to the Cabinet Top Panel (5 & 6).

NOTE: *Step 4 applies only to the Engine Side Compartment.*

4. Remove the Air Intake Pipe (9) by removing the four Bolts (10), Flatwashers (11), and Locknuts (12).
5. Remove the Cabinet Top Panel (5 & 6) by removing the 4 Bolts (13), eight Flatwashers (14), and four Nuts (16).

NOTE: *Follow the steps in reverse order to re-attach the hood and top panel.*

Deutz Engine



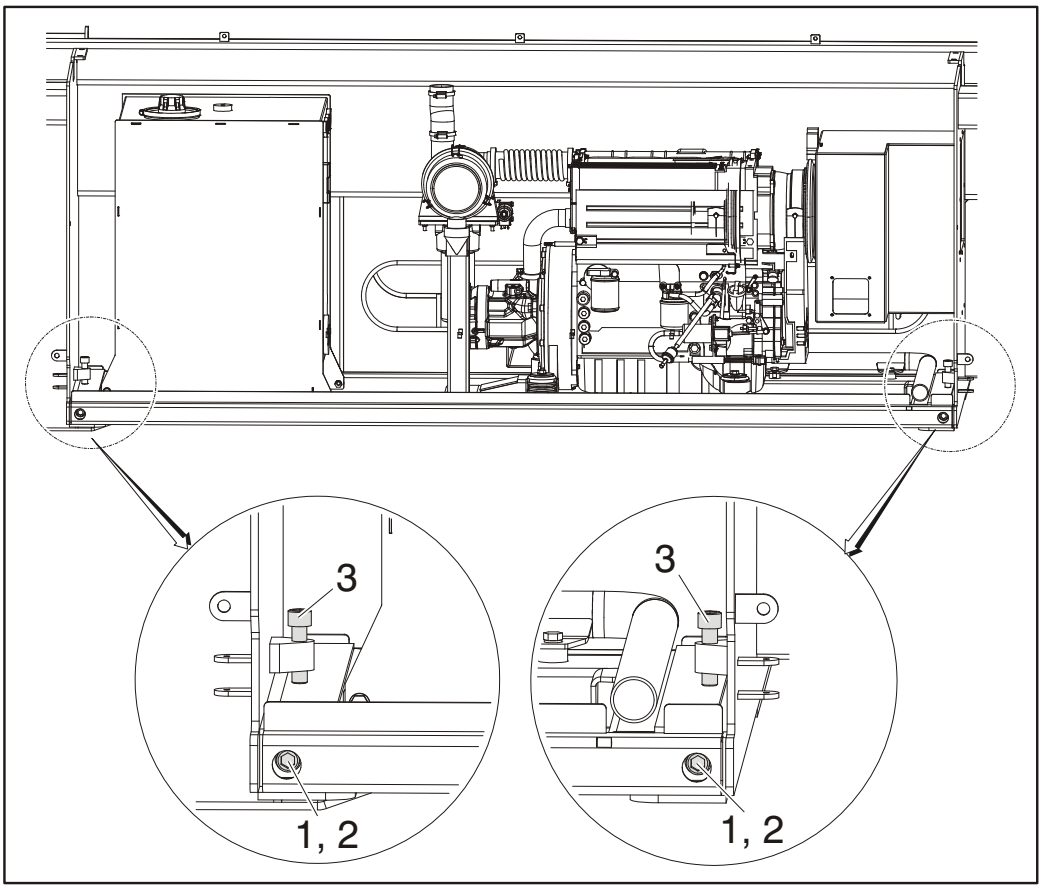
1. Diesel Engine
2. Air Filter
3. Air Intake
4. Hydraulic Oil Tank

Figure 3-11. Deutz F4L 2011

Table 3-4. Engine Technical Data

Description	Deutz F4L 2011	Deutz D2011 L04 i
# of cylinders	4	
Cylinder Arrangement	Vertical In Line	
Bore	94 mm	
Stroke	112 mm	
Total Displacement	3108 cm^3	
Working Cycle	4 Stroke Diesel Engine	
Specific Fuel Consumption	214 g/kWh	
Engine Speed: High Low	 2300 l/min 850 l/min	
Voltage	24 V	
Starter Battery (qty 2)	12 V, 88 Ah	
Alternator	14 V, 60 Ah	
Weight	256 kg	

Engine Tray Slide



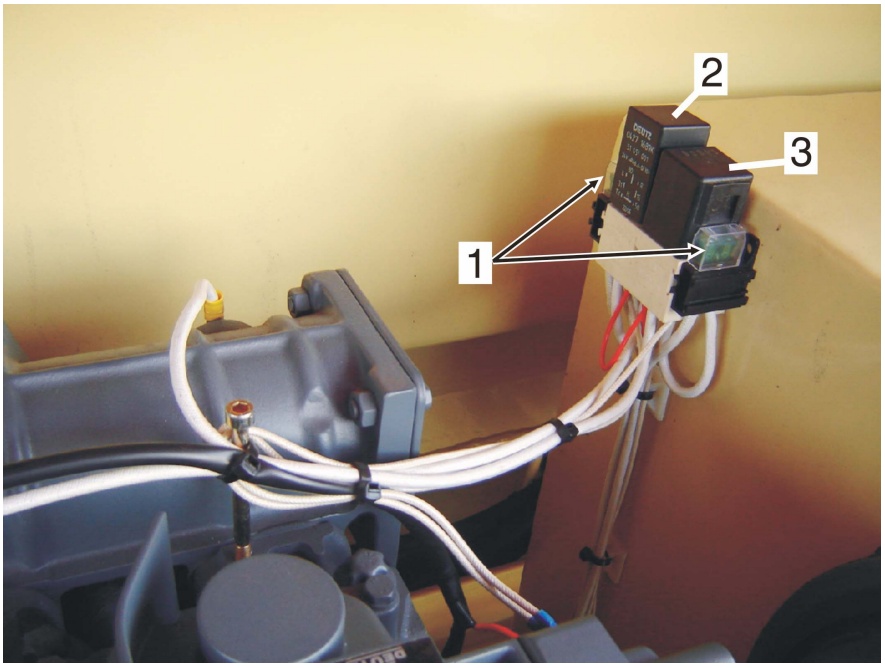
1. Capscrew, M16 x 30mm
2. Lockwasher, M16
3. Capscrew, M16 x 60mm

Figure 3-12. Engine Tray Slide

The engine tray can slide outward approximately 5.9 in. (15 cm) when servicing components inside the engine compartment.

1. Remove the two Capscrews (1) and Lockwashers (2) on the front of the engine tray.
2. Loosen the two top Capscrews (3) at both ends of the engine compartment. Slide engine tray outward.
3. Be sure to return engine tray to stowed position when finished servicing. Secure engine tray with the two front Capsrews (1) and Lockwashers (2) and two top Capscrews (3).

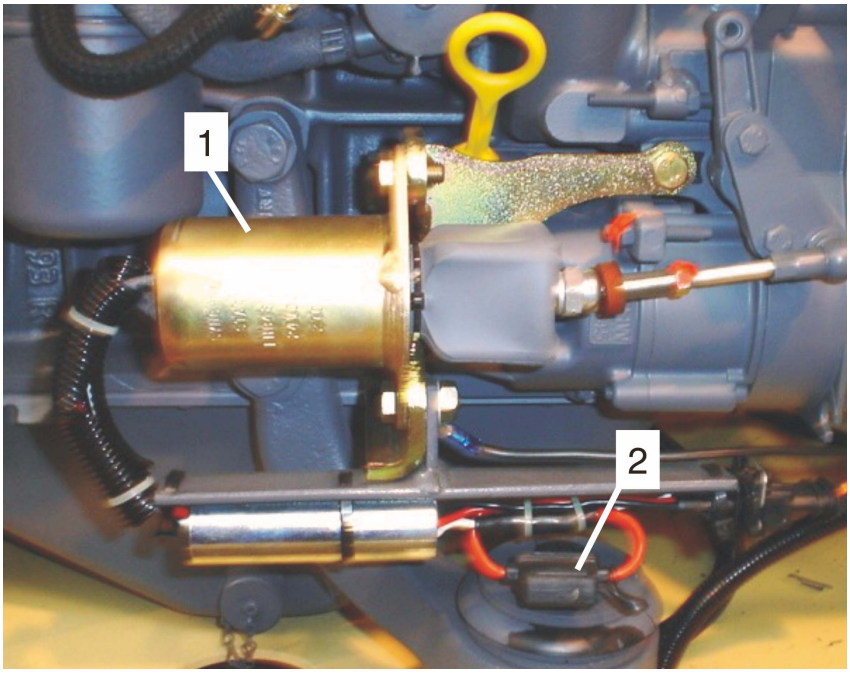
Glow Plugs



1. 30 amp Fuses
2. Timer Relay N6
3. Relay K3

Figure 3-13. Glow Plugs

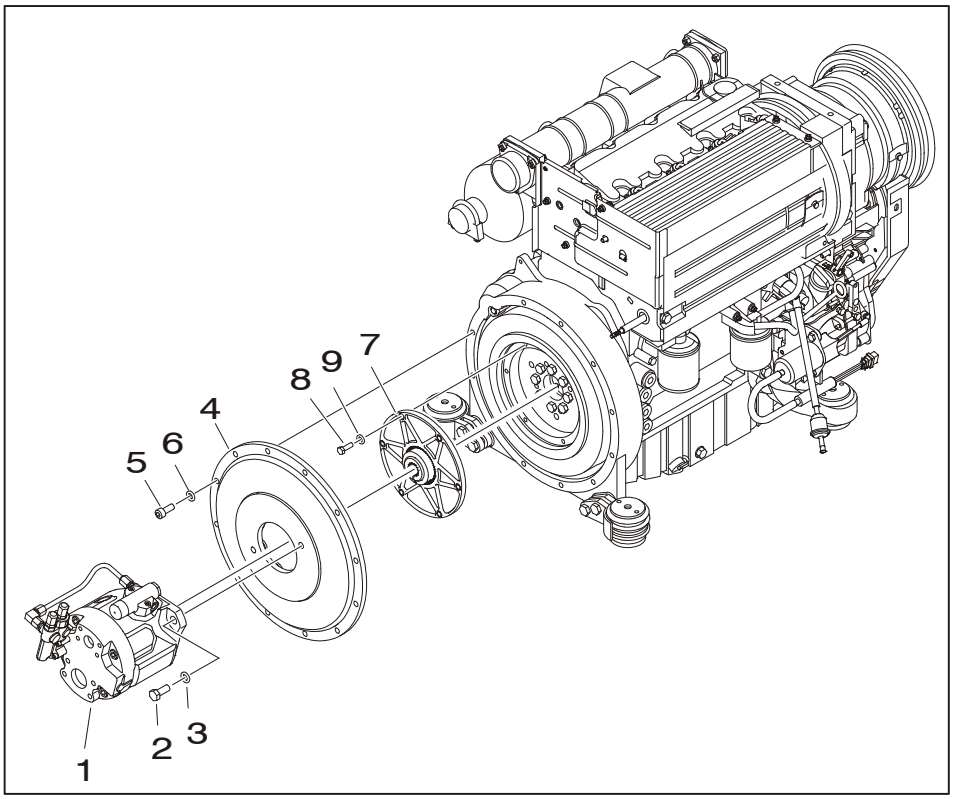
Engine Solenoid Fuse



1. Solenoid
2. 30 amp Fuse

Figure 3-14. Engine Solenoid

Hydraulic Pump Assembly



1. Hydraulic Pump
2. Bolt, M12 x 30mm
3. Lockwasher, M12
4. Flange
5. Capscrew, M10 x 25mm
6. Lockwasher, M10
7. Coupling
8. Hex Head Screw, M8 x 25mm - see installation note below
9. Lockwasher, M10

Figure 3-15. Hydraulic Pump Assembly

REMOVAL:

1. Disconnect any hoses and/or wires on the Hydraulic Pump (1).
2. Remove the two Bolts (2) and Lockwashers (3) connecting the pump to the Flange (4). Carefully remove the pump.
3. To remove the Flange, unscrew and remove the twelve Capscrews (5) and Lockwashers (6).
4. Remove the Coupling (7) by unscrewing and removing the six bolts (8) and Lockwashers (9).

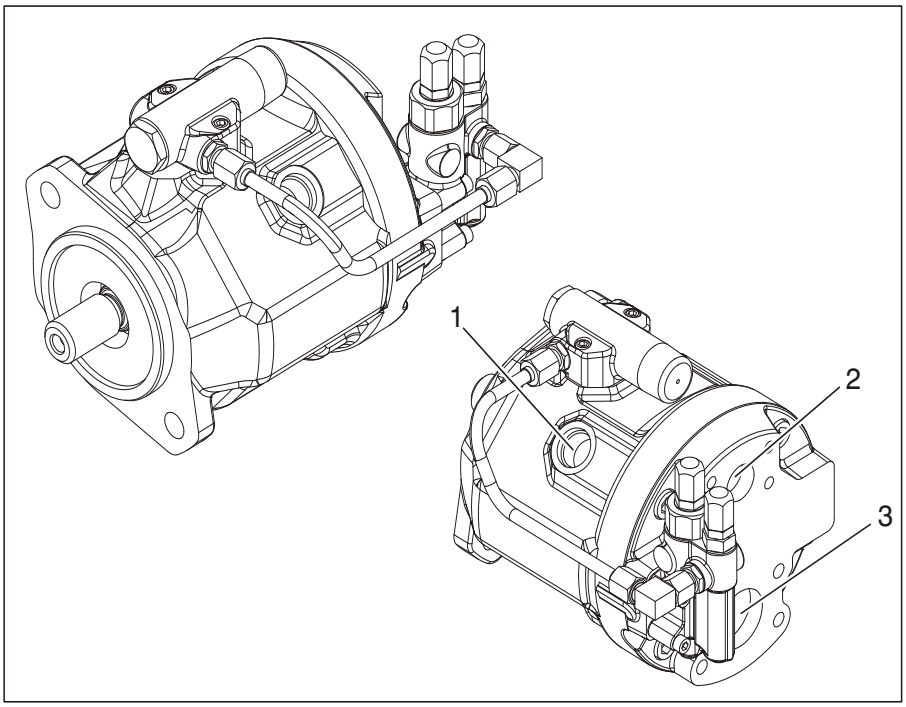
INSTALLATION:

1. Follow the Removal Procedures in reverse order when installing the hydraulic pump assembly.

   Torque item (5) Capscrews and lockwasher to 50Nm (37 lb-ft) DRY.

NOTE: *Do not reuse the lockwashers item (10) when reassembling item (8), Hexhead Screws. Apply Loctite #242 to the treads of item (8), Coupling Plate - Screws - M8 x 25mm upon reassembly and torque to 25Nm (18.5 lb-ft).*

Hydraulic Pump



1. Drain Port
   - tighten to 177 lb ft (240 Nm)
2. Pressure Port
   - tighten to 30 lb ft (40 Nm)
3. Inlet Port
   - tighten to 66 lb ft (90 Nm)

Figure 3-16. Variable Displacement Axial Piston Pump

Pump Flow

- Flow from the pump to the control valve is protected by a full flow and a load sensing dump valve, both normally-open to tank ports. To generate hydraulic power to the control valve, both dump valves need to be activated.

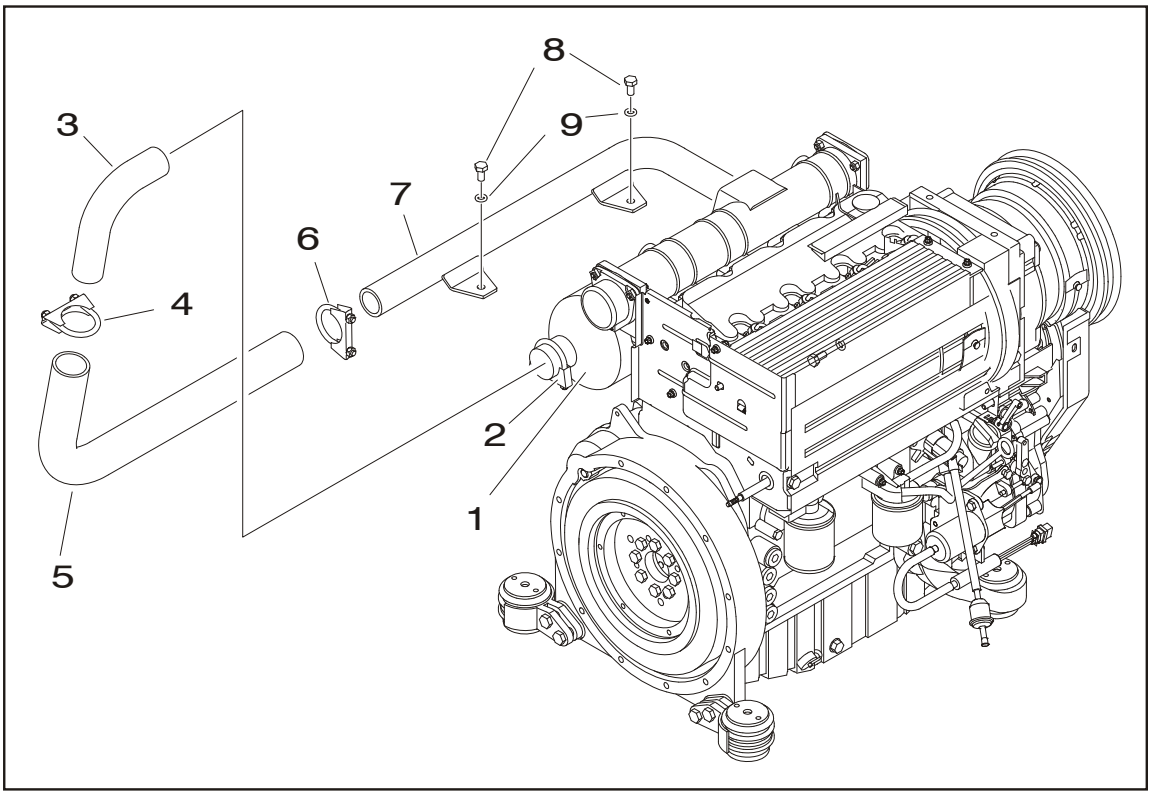
NOTICE

THIS PUMP IS FACTORY SET FOR FLOW, PRESSURE, AND HORSEPOWER CONTROL AND SHOULD NOT BE ADJUSTED. CONTACT THE JLG SERVICE DEPARTMENT FOR INFORMATION.

Table 3-5. Variable Displacement Axial Piston Pump Specs

Displacement	45 cc/rev
Max Speed	2300 rpm
Power	40 Kw
Delta "P"	203 psi at 3046 psi (14 bar at 210 bar)
Max Torque	146 lb ft (200 Nm)
Torque	53 lb ft (72 Nm)
Filling Volume	0.26 gal (1.0 L)
Nominal Pressure	4000 psi (280 bar)
Max Pressure	5100 psi (350 bar)
Weight (dry)	46.3 lbs (21 kg)

Exhaust Pipe Assembly



1. Muffler
2. Exhaust Clamp
3. Exhaust Elbow
4. Exhaust Clamp
5. Exhaust Flex Pipe
6. Exhaust Clamp
7. Tailpipe
8. Bolt, M10 x 20mm
9. Lockwasher, M10

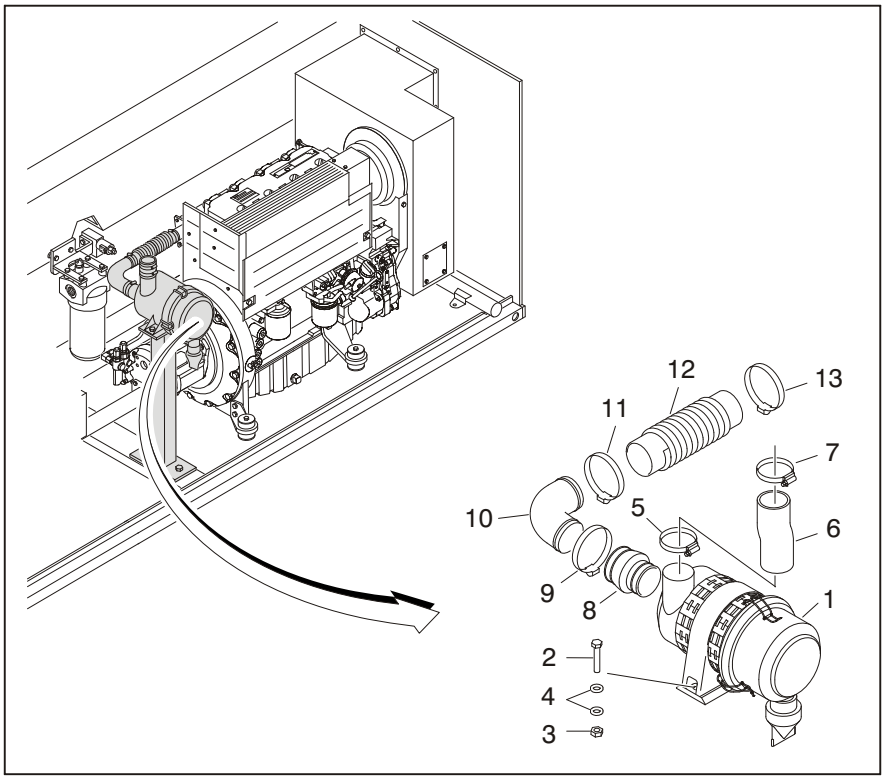
Figure 3-17. Exhaust Pipe Assembly

NOTE: *In the event any or all exhaust piping needs repaired or replaced follow the below steps. Refer to Figure 3-17., Exhaust Pipe Assembly.*

1. Loosen the Exhaust Clamp (2) located on the muffler (2).
2. Slide the Exhaust Elbow (3) out of the muffler.
3. Loosen the Exhaust Clamp (4).
4. The exhaust elbow can now be removed.
5. Remove the Exhaust Flex Pipe (5) by loosening the Exhaust Clamp (6). Slide the pipe out of the Tailpipe (7).
6. The tail pipe can be removed by unscrewing and removing the two Bolts (8) and Lockwashers (9) connecting the pipe to the engine tray.

NOTE: *Follow the previous steps in reverse order to install the exhaust system. Be sure to securely tighten the exhaust clamps.*

Air Filter Assembly



1. Air Filter
2. Bolt, M8 x 45mm
3. Flatwasher, M8
4. Locknut, M8
5. Hose Clamp Clip
6. Air Intake Hose
7. Hose Clamp Clip
8. Reducing Sleeve
9. Clamp
10. Air Intake Elbow
11. Clamp
12. Air Intake Hose
13. Clamp

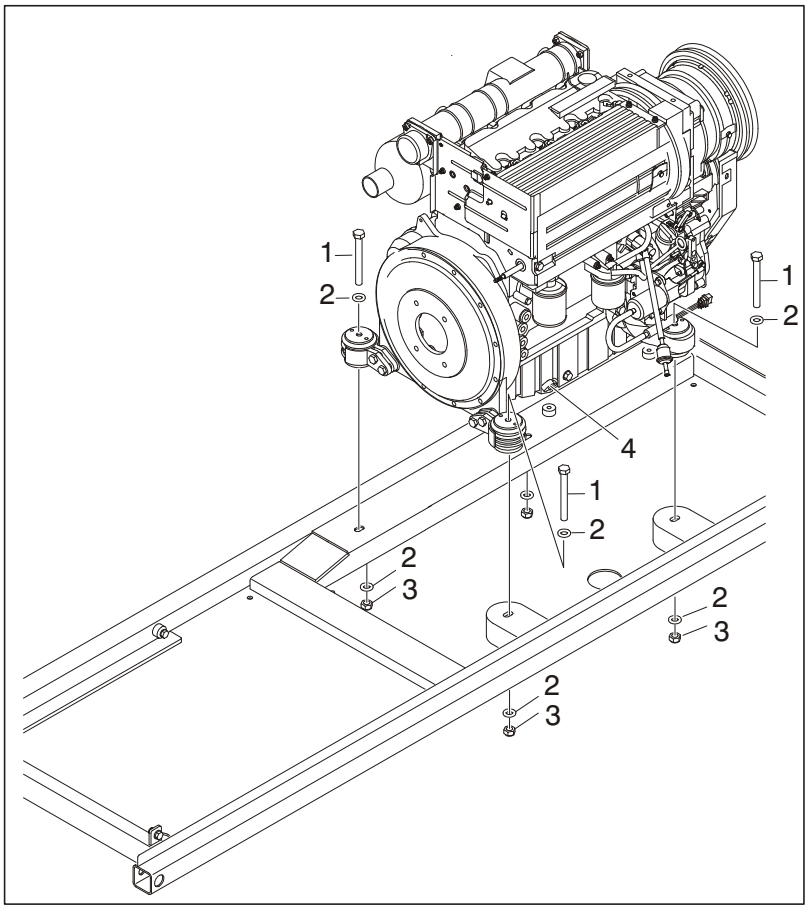
Figure 3-18. Air Filter Assembly

NOTE: *Refer to Figure 3-18. when dismantling the Air Filter for service and/or replacements. Follow the steps below when removing/installing any components.*

1. Removing the pipes and tubes requires loosening the hose clamps. Once the hose clamps are loosened, the tubes and pipes can be removed for maintenance or replacement.
2. To remove the Air Filter (1), unscrew and remove the 2 Bolts (2), four Flatwashers (4), and two Locknuts (3). Remove the air cleaner from the bracket.
3. Lift the latches on the end of the Air Filter for access to the safety element (not shown).

NOTE: *When assembling the air filter system, take care to securely fit all tubing and piping together and to securely tighten all hose clamps.*

Engine Removal



1. Bolt, M12 x 110mm
2. Flatwasher, M12
3. Locknut, M12
4. Oil Drain Port

Figure 3-19. Engine Removal

NOTE: *Refer to Figure 3-19. when removing engine from engine compartment.*

⚠ WARNING

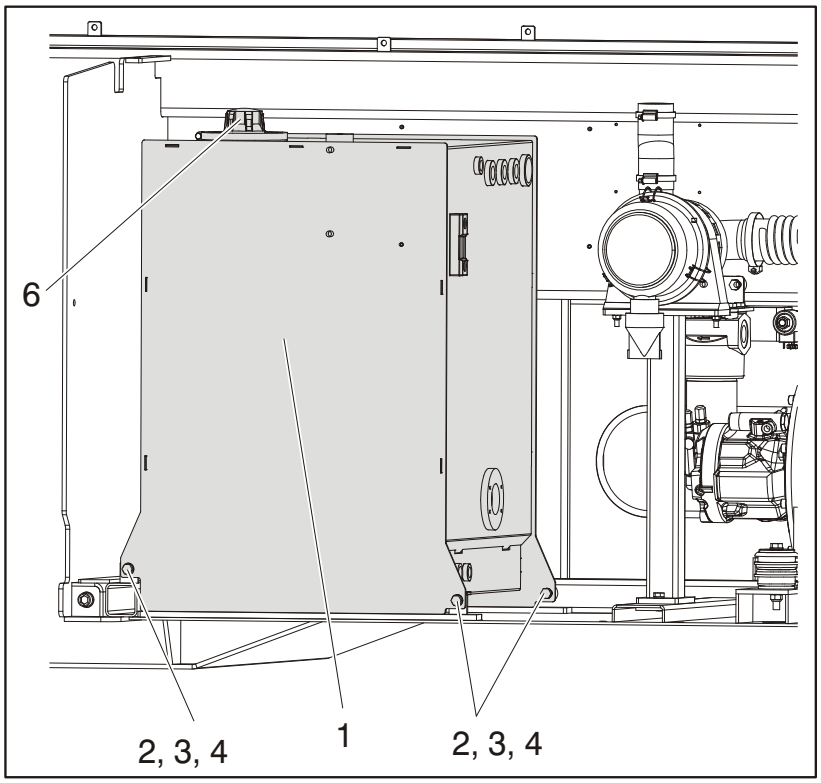
ENGINE REMOVAL REQUIRES HEAVY LIFTING DEVICES. USE EXTREME CAUTION WHEN REMOVING THE ENGINE.

1. Disconnect electrical supply.
2. Disconnect all electrical wires, hoses, pipes, etc. attached to the engine assembly.
3. Secure engine with appropriate lifting device. (Refer to Deutz Operation Manual included with the machine)
4. Unscrew and remove 4 Nuts (3) and Flatwashers (2) from the underside of the engine tray.
5. Remove all 4 Bolts (1) and second set of Flatwashers.
6. Carefully lift engine from engine compartment with appropriate lifting device.

NOTE: *When installing the engine, follow the steps in reverse order.*

The machine comes with an engine oil drain hose (located in the plastic bag in the valve compartment) to use when draining the oil from the engine. Remove the cover on the Oil Drain Port (4). Attach the drain hose to the Port. The valve on the hose releases the valve on the Port to drain the oil. Run the hose through the opening on the bottom of the engine tray.

Hydraulic Tank



1. Hydraulic Tank
2. Capscrew, M10 x 25mm
3. Flatwasher, M10 (2 per capscrew)
4. Nut, M10
5. Shutoff Valve Lever
6. Filler

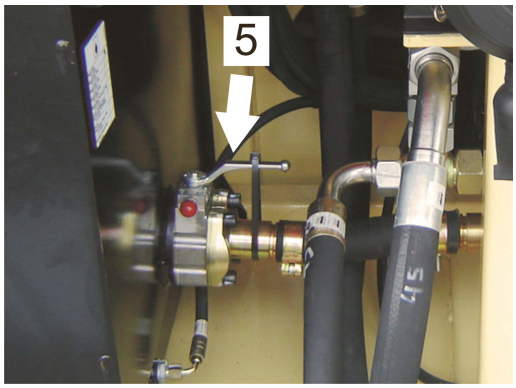


Figure 3-20. Hydraulic Tank Removal

Removal:

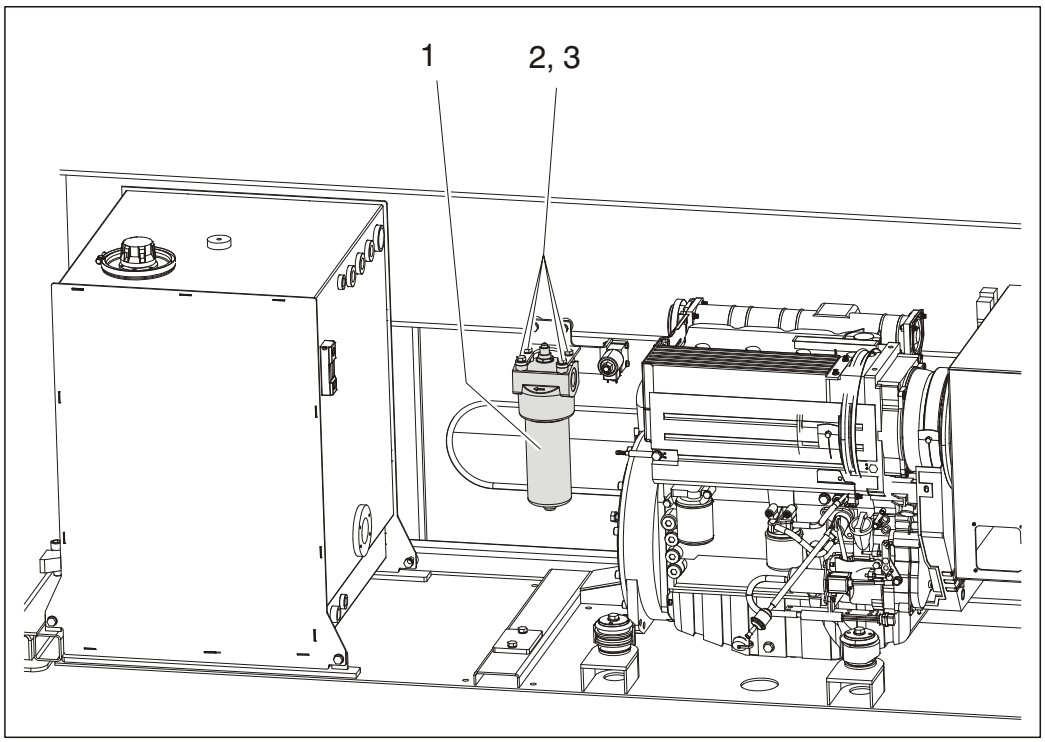
1. Close shutoff valve lever (5) to turn off flow of hydraulic fluld. Drain hydraulic fluid by opening the drain port on the underside of the Hydraulic Tank (1). Store fluid in appropriate receptacle. Disconnect all hoses.
2. Remove hydraulic tank by removing the four Capscrews (2), Nuts (4) and eight Flatwashers (3).
3. Carefully remove the tank from the engine compartment.
4. If required, remove and replace Filter (see Figure 3-21.).

NOTE: *Close hydraulic shutoff valve lever when servicing the hydraulic system and components. Make certain to open lever when finished to return flow of hydraulic fluid.*

Installation:

1. Place tank into engine compartment lining up the bolt holes.
2. Replace Capscrews, Flatwashers and Nuts into their respectable holes. Tighten.
3. Replace all hydraulic hoses.
4. Ensure the drain port is closed.
5. If required, replace Filter.
6. Remove Filler cap (6) fill tank with hydraulic fluid to its designated capacity, 68.7 gal (260 L).
7. Open shutoff valve lever to turn on flow of hydraulic fluid.

Pressure Filter



1. Pressure Filter
2. Capscrew, M10 x 20mm
3. Lockwasher, M10

Figure 3-21. Pressure Filter Removal

Removal:

1. Disconnect hose(s) from the Pressure Filter (1).
2. Loosen and remove the four Capscrews (2) and Lockwashers (3).
3. Remove the Pressure Filter.

NOTE: *Replace filter every 250 hours of operation.*

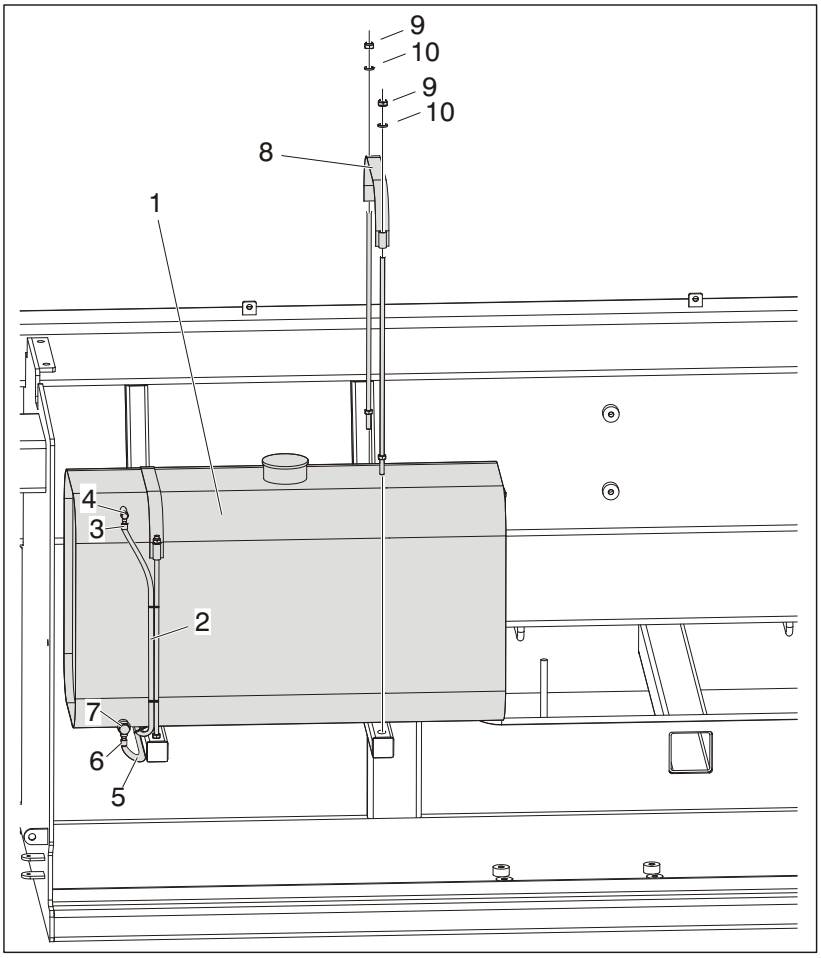
Installation:

1. Align the pressure filter so that the screw holes match up with the screw holes on the holding bracket.

NOTE: *Be sure arrow on top of filter points towards the hydraulic tank.*

2. Insert the four Lockwashers and Capscrews into the holes and tighten.
3. Reconnect any hose(s) disconnected during removal.

3.8 FUEL TANK



1. Fuel Tank
2. Fuel Line Hose, 5.5 mm
3. Clamp
4. Hose Fitting
5. Fuel Line Hose, 7.5mm
6. Clamp
7. Hose Fitting
8. Fuel Tank Strap
9. Nut, M8
10. Lockwasher, M8

Figure 3-22. Fuel Tank Removal

Removal:

NOTE: *Drain Fuel Tank (1) before removing. Store diesel fuel in approved receptacle.*

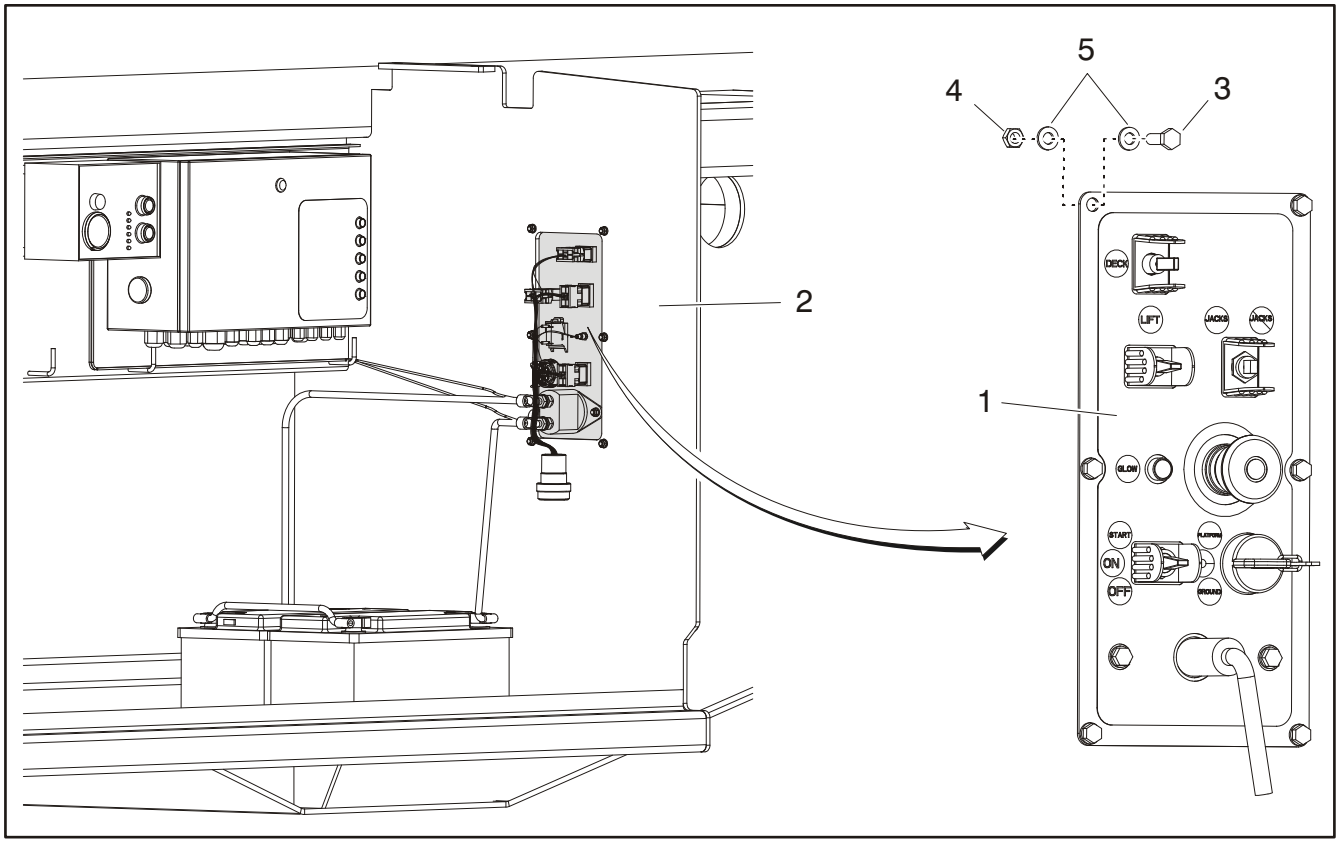
1. Disconnect the Fuel Line Hoses (2, 5) from the fuel tank by loosening the Clamps (3, 6). Pull hose from Hose Fittings (4, 7).
2. Remove the Fuel Tank (1) by removing the four Nuts (9) and Lockwashers (10) on the two fuel Tank Straps (8).

Installation:

1. Place Fuel Tank onto the chassis. Secure tank with Fuel Tank Strap. Fasten with Bolts and Lockwashers.
2. Secure Hose Fittings to Hoses with Clamps.
3. Refuel Tank with diesel fuel.

NOTE: *Empty fuel tank weighs approximately 36.6 lbs (16.6 kg).*

3.9 GROUND CONTROL PANEL



1. Ground Control Panel
2. Electrical Compartment
3. Bolt, M6 x 20mm
4. Nut, M6
5. Flatwashers, M6

Figure 3-23. Ground Control Panel Removal

Removal:

NOTICE

DISCONNECT GROUND CONTROL PANEL (1) FROM BATTERY BEFORE REMOVING AND/OR SERVICING.

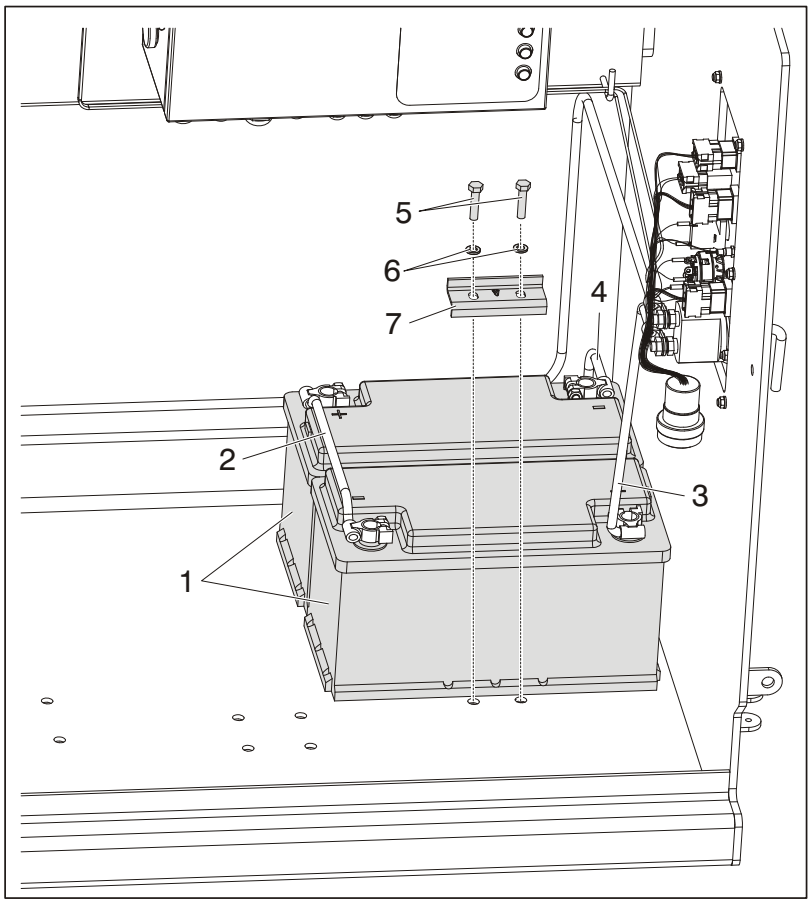
1. Disconnect all plugs and wires from the back of the control panel.
2. Remove the panel from the the Electrical Compartment (2) by removing the six Bolts (3), Nuts (4), and twelve Flatwashers (5).

NOTE: *When removing the control panel, take care not to damage any plug receptacles and switches.*

Installation:

1. Attach the Ground Control Panel to the Electrical Compartment with the Bolts, Flatwashers, and Nuts.
2. Carefully attach all wires and reconnect to battery.
3. Make certain all LED's and switches work properly.

3.10 BATTERY REMOVAL



1. Batteries
2. Battery Cable (Battery - to Battery +)
3. Battery Cable (Battery + to Battery Disconnector)
4. Battery Cable (Battery - to Engine)
5. Bolts, M8 x 35mm
6. Lockwashers, M8
7. Battery Hold Clamp

NOTE: *Items 5, 6, and 7 are also located on the back side of the battery (not shown)*

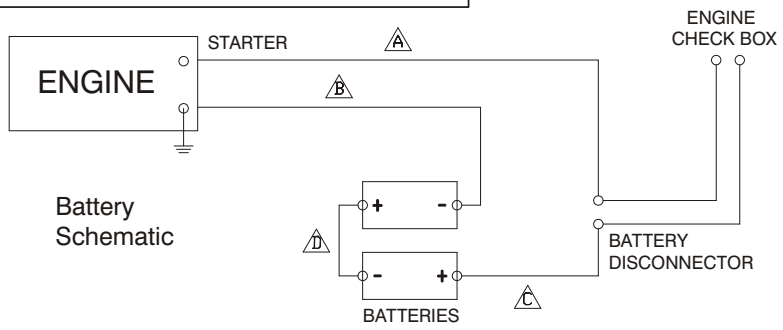


Figure 3-24. Battery Removal

Removal:

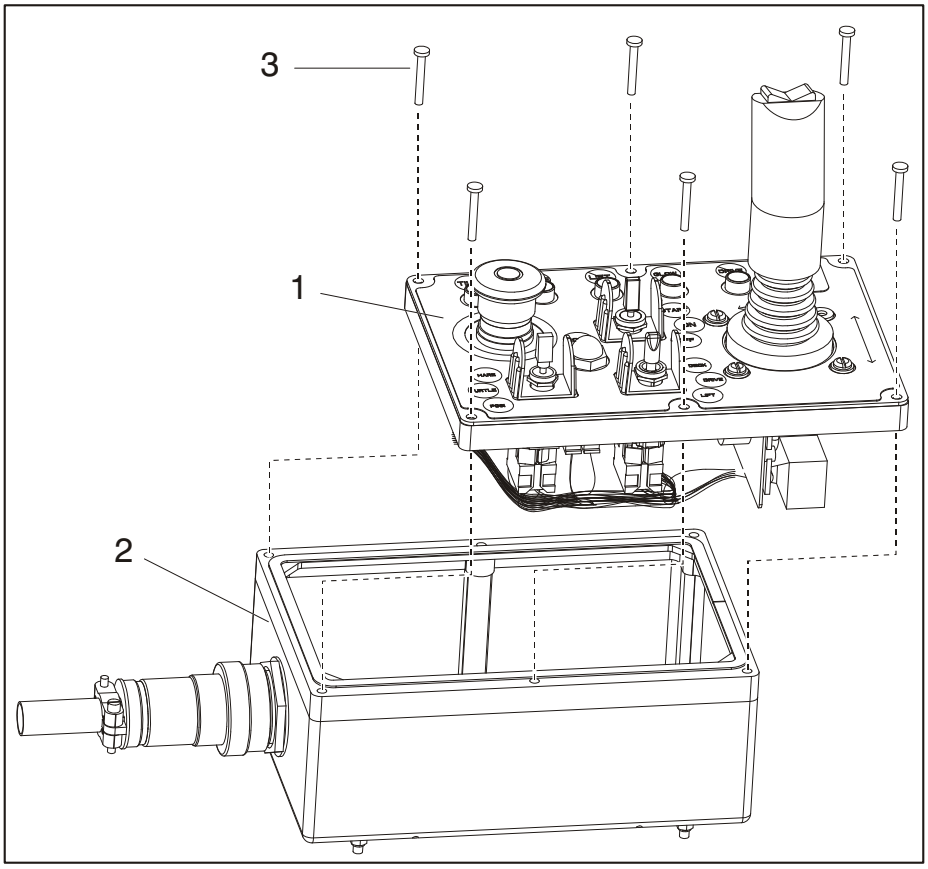
1. Disconnect and remove the Battery Cables (2, 3, 4) from the battery terminals. Loosen the bolt on the terminal clamps to remove the cables.
2. Remove the Bolts (5), Flatwashers (6) securing the both the front (shown) and rear (not shown) Battery Hold Clamp (7) to the electrical compartment.
3. Remove the Battery Hold Clamp.
4. Remove Batteries(1).

Installation:

1. Place Batteries into electrical compartment.
2. Align Battery Hold Clamps with bolt holes on floor.
3. Secure Clamps with Bolts and Lockwashers.
4. Reconnect Battery Cables to the battery terminals. Tighten bolt on the terminal clamps.

3.11 PLATFORM

Platform Control Box



1. Control Box Lid
2. Control Box
3. Screw, M4 x 30

Figure 3-25. Platform Control Box

For access to the inside of the platform control box, follow these steps:

1. Disconnect platform control box connector from the machine.
2. Remove the six Screws (3) securing the Control Box Lid (1) to the Control Box (2).
3. Carefully lift the lid from the box.
4. At this point, wires, plugs, and other parts may be disconnected for repair/replacement.

NOTE: *When assembling the platform control box, be careful not to pinch wires when replacing the lid back onto the box.*

Joystick Controller

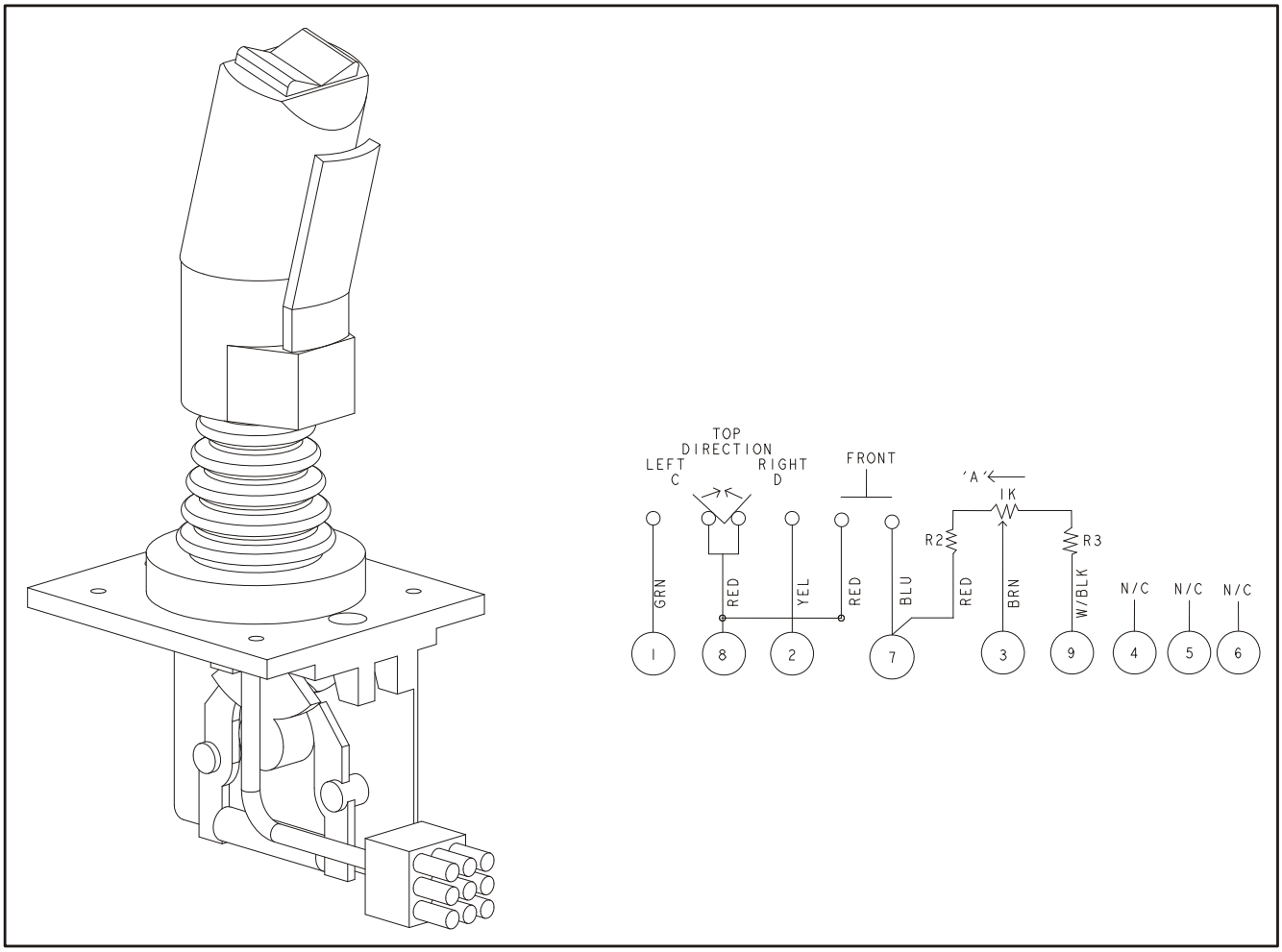


Figure 3-26. Joystick

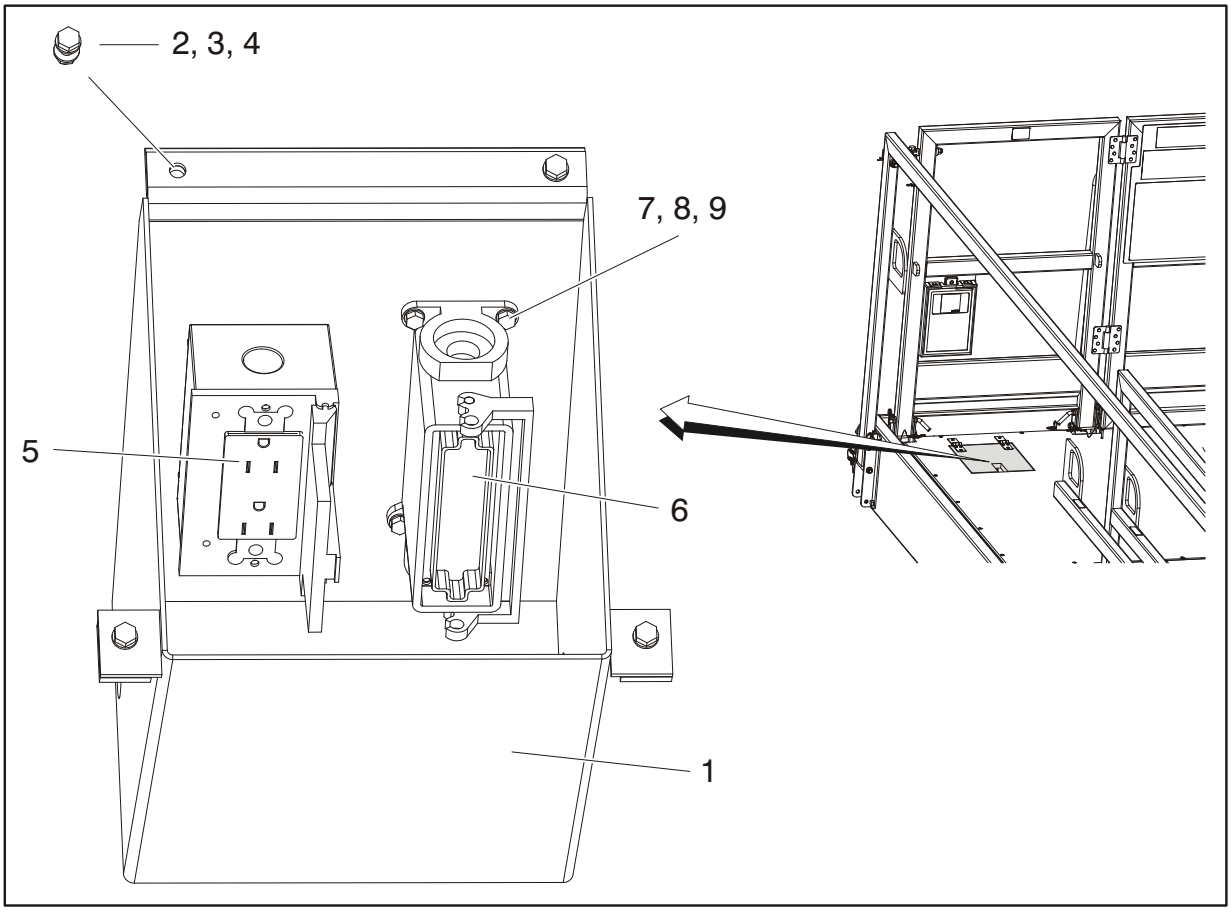
Table 3-6. Joystick Specifications

Input Voltage	24V (±0.05V)
Centered Output Voltage	12V (±0.25V)
Reverse Voltage	5.5 - 6.5V
Forward Voltage	17.5 - 18.5V

Table 3-7. Plug Loading Chart

Terminal	Color	Function
1	Green	Steer Left
2	Yellow	Steer Right
3	Brown	Pot Out
4	N/C	
5	N/C	
6	N/C	
7	Blue	24V In
8	Red	Enable / 24V Out
9	White / Black	Ground

Receptacles



1. Receptacle Box
2. Bolt, M6 x 20mm
3. Flatwasher, M6 (qty 2)
4. Nut, M6
5. 110V Receptacle
6. Platform Control Box Outlet
7. Bolt, M5 x 16
8. Flatwasher, M5 (qty 2)
9. Nut, M5

Figure 3-27. Platform Receptacle Box Removal

⚠ WARNING

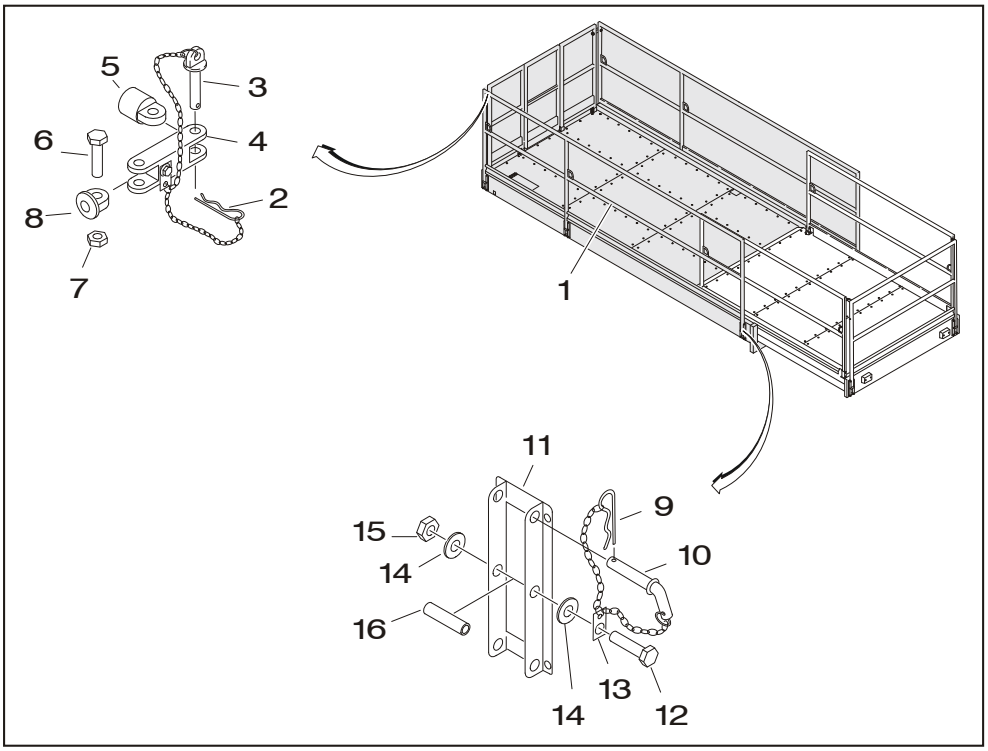
DISCONNECT BATTERY SUPPLY ON GROUND CONTROL PANEL BEFORE REMOVING RECEPTACLE BOX.

1. Remove front platform floor panel to expose the bolts connecting the Receptacle Box (1) to the platform.
2. Disconnect all wires connected to the 110V Receptacle (5) and Platform Control Box Outlet (6).
3. Remove the four Bolts (2), eight Flatwashers (3), and four Nuts (4).
4. Lift box from platform.
5. The 110V Receptacle (5) can be removed from the box by removing the four screws on the backside.
6. The Platform Control Box Outlet (6) can be removed by removing the four Bolts (7), eight Flatwashers (8), and four Nuts (9).

Installation:

1. Follow Removal steps in reverse order.

Main Platform Side Rails



1. Side Rail
2. Cotter Pin
3. Pin
4. Bar
5. Pin
6. Bolt, M12 x 40mm
7. Locknut, M12
8. Pin
9. Cotter Pin
10. Pin
11. Hinge Bracket
12. Bolt, M10 x 120mm
13. Chain Assembly Mounting Plate
14. Flatwasher, M10
15. Locknut, M10
16. Tube

Figure 3-28. Side Rails Removal

NOTE: *Before rails can be lowered, loosen the bolt on the plastic rail-guide rollers and lower the roller so that it is not hindering the lowering of the rails.*

NOTICE

SIDE RAILS WEIGH APPROXIMATELY 72.3 LBS (32.8 KG) EACH. USE CAUTION WHEN REMOVING ANY PLATFORM RAIL.

NOTE: *All procedures apply to the opposite side.*

Removal:

NOTE: *The below procedures apply to both right and left side rails.*

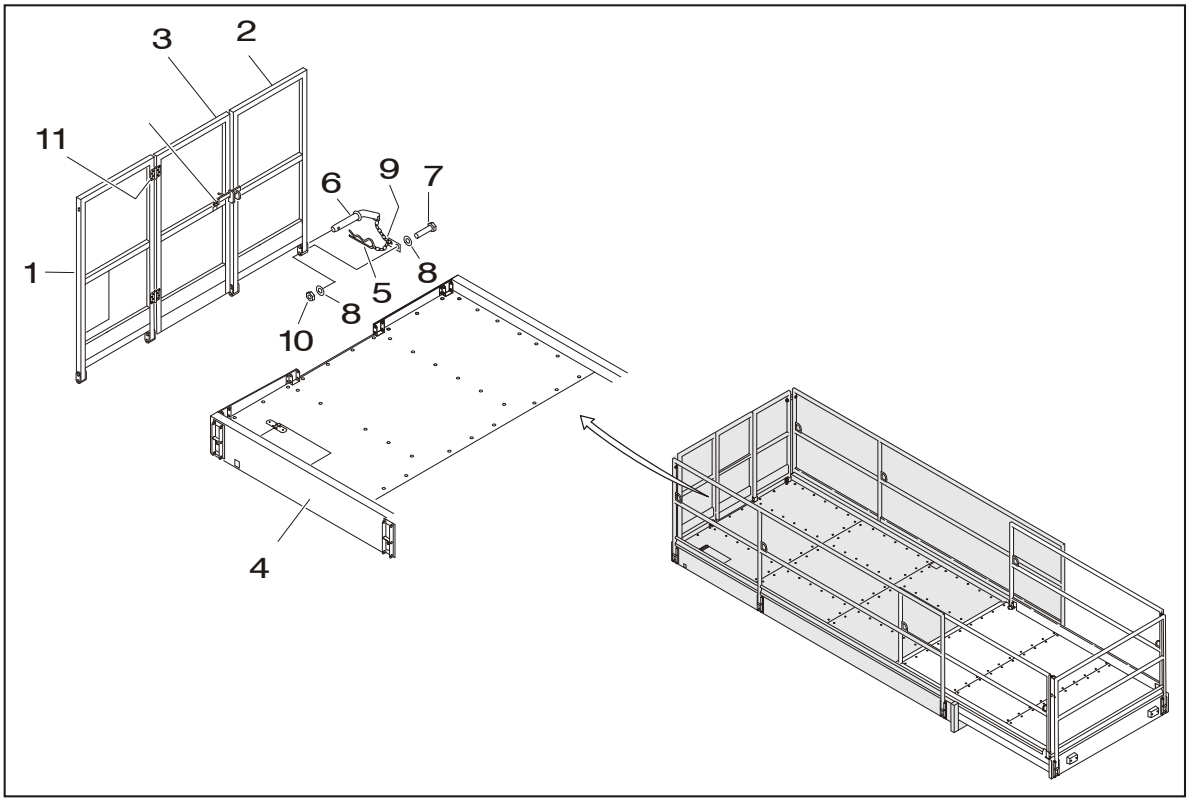
1. Disconnect side rail (1) from the end rail by pulling the Cotter Pin (2) from the Pin (3). Remove the Pin from the Bar (4) and Pin (5) located on the end rail.
2. Remove the Cotter Pins (9) from the Pins (10) on all three Hinge Brackets (11). Pull the Pin out of the side rail. Carefully fold rail down to the stowed position.
3. Side rail can now be removed from the platform by removing the Bolts (12), Chain Assembly Mounting Plates (13), Flatwashers (14) and Locknuts (15) on all three rail legs.
4. Remove the Tubes (16) once the rail is removed.

Installation:

NOTE: *The below procedures apply to both the right and left side rails.*

1. Follow the removal procedures in reverse order when installing the side rails.

Main Platform End Rails



1. End Rail (right side)
2. End Rail (left side)
3. Gate
4. Platform
5. Cotter Pin
6. Pin
7. Bolt, M10 x 120mm
8. Flatwasher, M10
9. Chain Assembly Mounting Plate
10. Locknut, M10
11. Hinge

Figure 3-29. End Rail Removal

Removal:

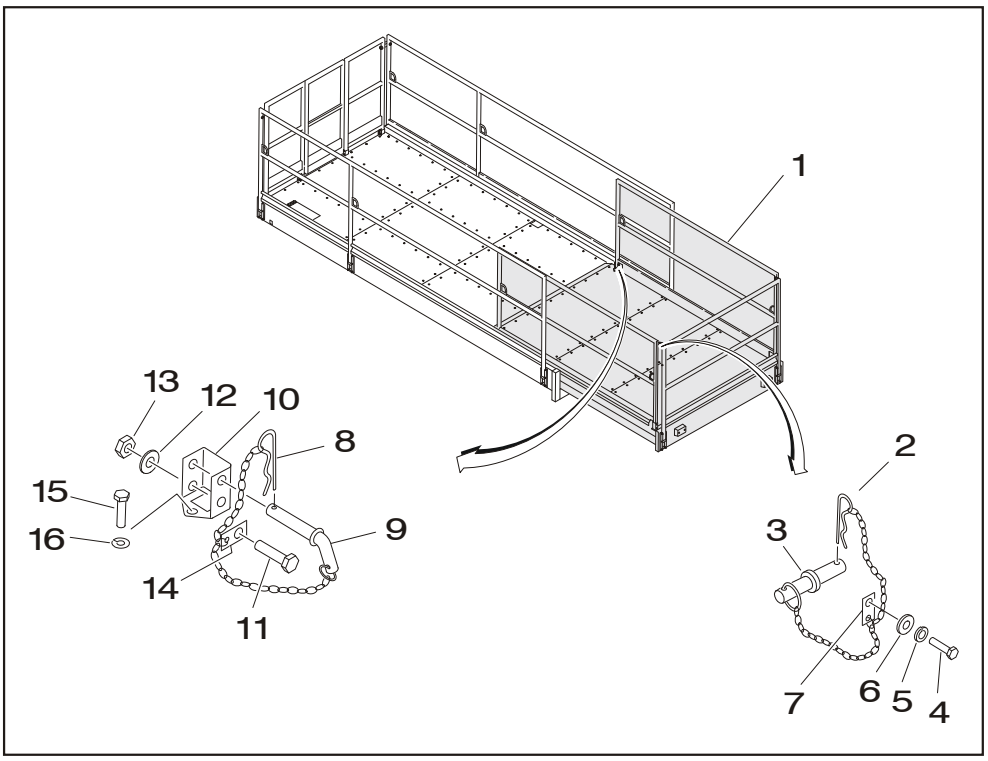
1. If applicable, disconnect end rails (1,2,3) from side rails. (see removal instructions for side rails on previous page).
2. Remove Cotter Pins (5) from Pins (6) on rail legs.
3. Fold rails down to the stowed position.
4. Remove Bolts (7), Flatwashers (8), Locknuts (10), and Chain Assembly Mounting Plates (9).
5. Carefully remove the rail.
6. The Gate (3) can be detached from the right side End Rail (1) by removing the screws on the two Hinges (11).

Installation:

NOTE: *Place the rail(s) on the platform in their stowed position when installing.*

1. Follow the removal instructions in reverse order.
2. Attach End Rails to Side Rails via the pins in Figure 3-28.

Platform Extension Side Rails



1. Extension Side Rail
2. Cotter Pin
3. Pin
4. Bolt, M6 x 16mm
5. Lockwasher, M6
6. Flatwasher, M6
7. Chain Assembly Mounting Plate
8. Cotter Pin
9. Pin
10. Extension Rail Bracket
11. Bolt, M12 x 100mm
12. Flatwasher, M12
13. Locknut, M12
14. Chain Assembly Mounting Plate
15. Bolt, M10 x 25mm
16. Lockwasher, M10

Figure 3-30. Extension Side Rails Removal

NOTICE

THE EXTENSION SIDE RAILS WEIGH APPROXIMATELY 58 LBS (26.2 KG) EACH. USE CAUTION WHEN REMOVING ANY PLATFORM RAIL.

NOTE: *All procedures apply to the opposite side.*

Removal:

1. Disconnect Side Rails (1) from end rail by removing Cotter Pin (2) from Pin (3).

NOTE: *The Chain Assembly/Pin/Cotter Pin can be removed by removing the Bolt (4), Lockwasher (5), and Flatwasher (6).*

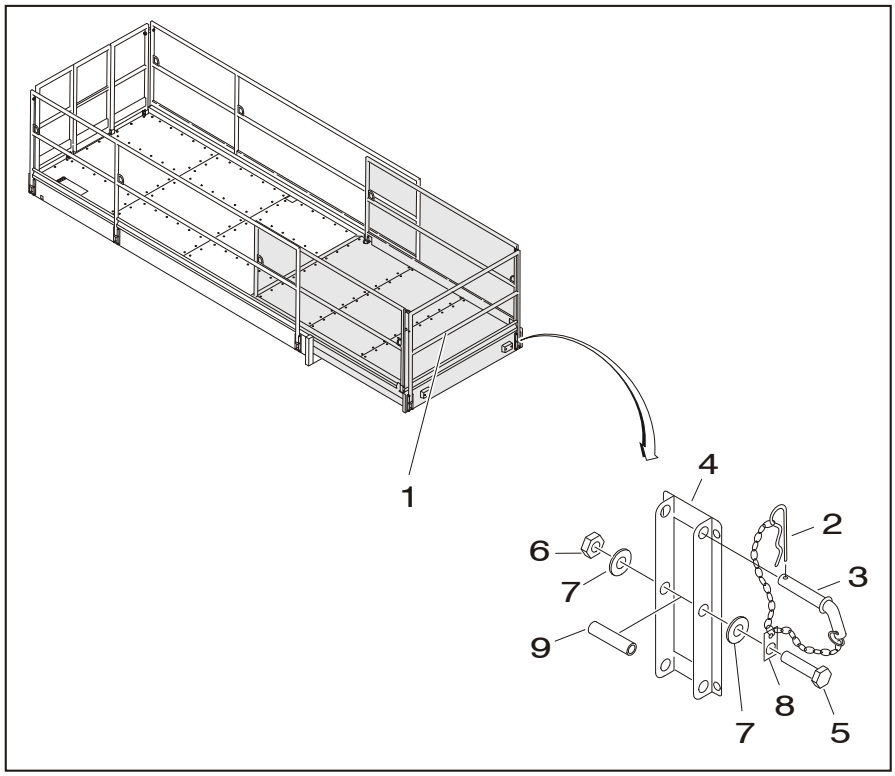
2. Remove the Cotter Pins (8) from the Pins (9) on each Bracket (10). Pull the pin out of the bracket.
3. Carefully fold rails inward to the stowed position.
4. Remove the Bolts (11), Locknuts (13), Flatwashers (12), and Chain Assembly Mounting Plates (14). The rail can now be removed.

Installation:

NOTE: *Place the rail(s) on the platform in their stowed position when installing.*

1. Follow the removal instructions in reverse order.

Platform Extension End Rail



1. Extension End Rail
2. Cotter Pin
3. Pin
4. Hinge Bracket
5. Bolt, M10 x 120mm
6. Locknut, M10
7. Flatwasher, M10
8. Chain Assembly Mounting Plate
9. Tube

Figure 3-31. Extension End Rail Removal

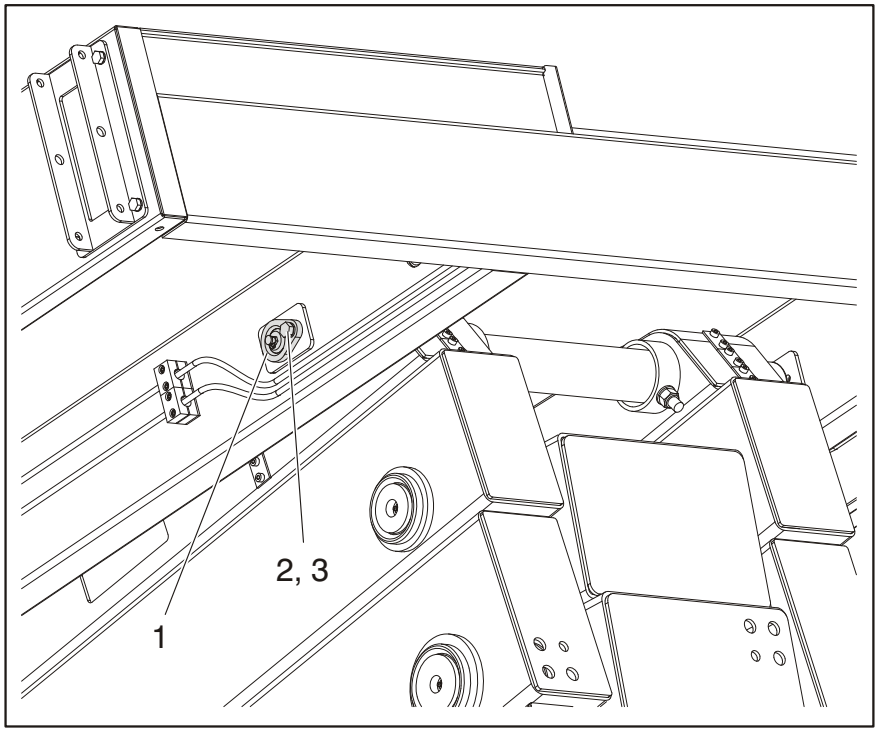
Removal

1. If applicable, detach the end rail (1) from the side rails (see removal instructions for side rails on previous page).
2. Remove Cotter Pins (2) from Pins (3).
3. Pull Pins out of Hinge Brackets (4).
4. Carefully lower rail to its stowed position.
5. Secure rail.
6. Remove the Bolts (5), Locknuts (6), Flatwashers (7), and Chain Assembly Mounting Plate (8).
7. Carefully remove the rail.
8. Remove the Tube (9) from the rail.

Installation

1. Follow the Removal instructions in reverse order when installing the platform extension end rail.

Platform Removal



1. Platform Pivot Pin
2. Bolt, M12 x 25mm
3. Lockwasher, M12

NOTE: *Illustration shows scissor arm assembly connection point to underside of platform at the front of the platform.*

Figure 3-32. Platform Removal - 1 of 2 (Front of Platform)

Machine Stabilization:

The arm stack can be supported by using an overhead crane, Figure 4-31. If an overhead crane is not available the stack may also be lifted by using a forktruck using the following instructions:

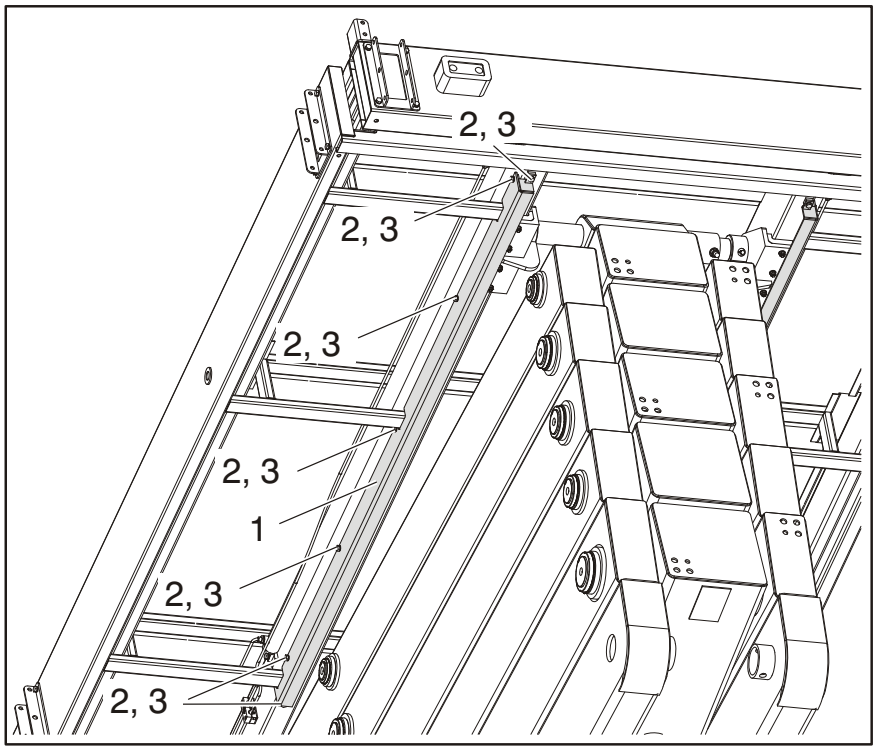
1. With the forks on the forktruck slid close together, enter from the front of the machine and place the forks on the cross tube of the second arm weldment below the platform.
2. Slowly lift the arm stack with the forktruck while the manual descent valve is being engaged (this allows the oil to drain back into the tank).
3. Place machine on safety prop and leave the forktruck in place.

If removal of the platform becomes necessary use the above procedure to stabilize the platform for pin and platform removal.

NOTE: *Procedures apply to both left and right sides.*

Removal:

1. Disconnect all wiring and hydraulic lines attached to the platform or platform components. Cap hydraulic lines to prevent leakage.
2. Support the platform along the sides with the forktruck forks or use suitable straps or chains at the four corners of the platform.
3. Remove the two Bolts (2) and Lockwashers (3) attaching the two Platform Pivot Pins (1) to the Platform.
4. Continue on to the rear of the machine. (See next page)



1. Platform Retaining Bracket
2. Bolt, M10 x 16mm
3. Lockwasher, M10

NOTE: *Illustration shows scissor arm assembly connection point to underside of platform at the rear of the platform.*

Figure 3-33. Platform Removal - 2 of 2 (Rear of Platform)

Platform Removal:

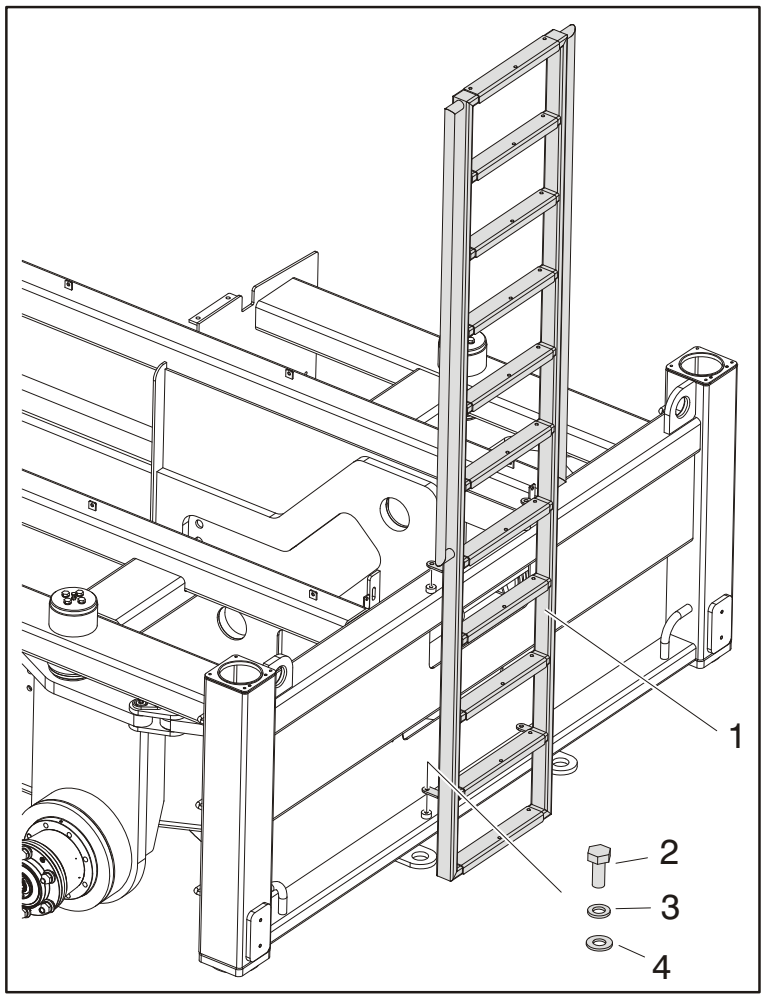
NOTE: *Procedures apply to both left and right sides.*

1. Support the platform along the sides with the fork-truck forks or use suitable straps or chains at the four corners of the platform.
2. Remove the fourteen Bolts (2) and Lockwashers (3) attaching both Platform Retaining Brackets (1) to the Platform.
3. Lift the platform from the armstack.

Installation:

1. The removal steps should be followed in reverse order when installing the platform.

3.12 LADDER INSTALLATION



1. Ladder
2. Bolt, M10 x 25mm
3. Spring Lockwasher, M10
4. Flatwasher, M10 (if applicable)

Figure 3-34. Ladder Installation

Removal:

1. The ladder can easily be removed from the chassis by removing the four Bolts (2), Spring Lockwashers (3), and Flatwashers (4).

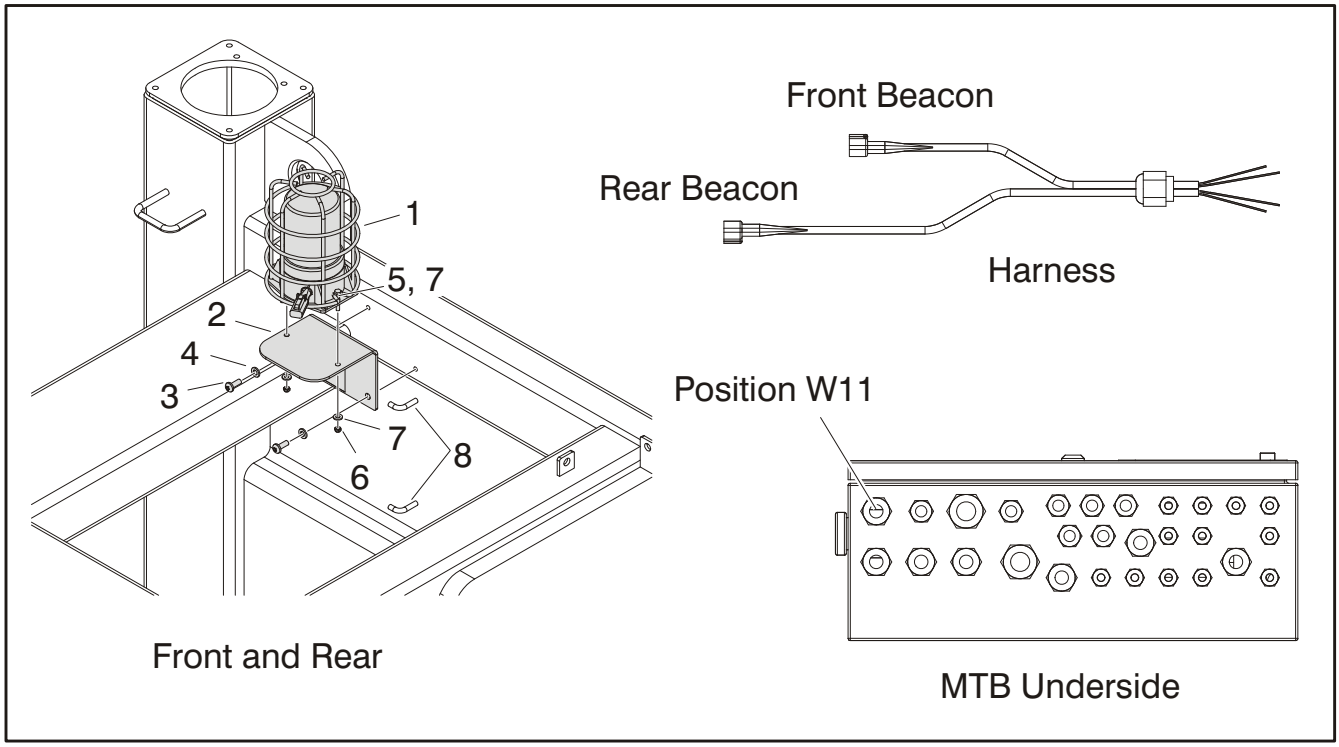
⚠ CAUTION

USE CAUTION WHEN REMOVING THE LADDER. THE LADDER WEIGHS APPROXIMATELY 104 LBS (47.2 KG).

Installation:

1. Lift ladder so that the four mounting brackets align with the bolt holes on the chassis.
2. Secure ladder to the chassis with the four Bolts (2), Spring Lockwashers (3), and Flatwashers (4).

3.13 BEACON INSTALLATION (OPTION)



1. Beacon & Protective Cage
2. Mounting Bracket
3. Screw, 6mm x 16mm
4. Washer, 6mm
5. Bolt, M4 x 25mm
6. Nut, M4
7. Washer
8. Guiding Rods

Figure 3-35. Beacon Installation

Removal:

NOTE: *Procedures apply to both the Front and Rear Beacons.*

1. Disconnect electrical supply.
2. Disconnect beacon harness from beacon and MTB, if needed.
3. Remove Bolts (5), Nuts (6), and Washers (7) to remove the Beacon and Protective Cage (1).
4. The Mounting Bracket (2) can be removed from the chassis by removing the two Screws (3) and Washers (4).
5. Repair/Replace if necessary.

Installation:

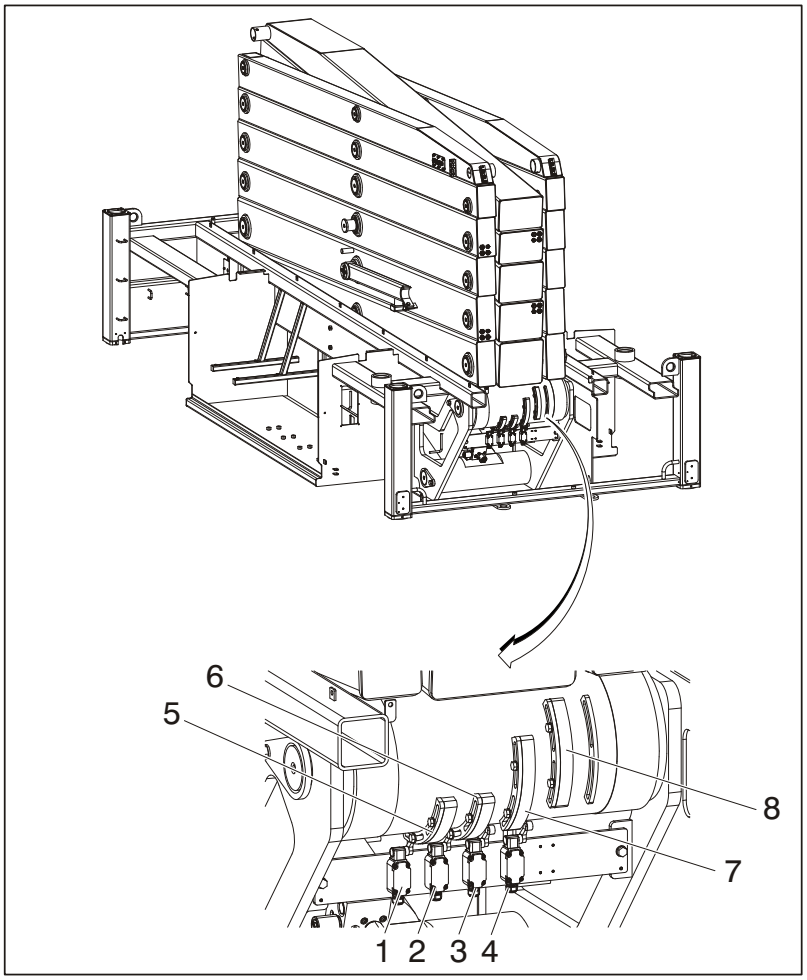
1. Follow Removal Procedures in reverse order.
2. Route Front Beacon Cable behind the Guiding Rods (8) to avoid contact with the tie bar. Follow route of the signal cable for Outrigger 1. Fix with tie straps.
3. Route Rear Beacon Cable together with signal cable for Outrigger 3. Fix with tie straps.
4. Route Harness through Position W11 on the underside of the Main Terminal Box (MTB).

Table 3-8. Beacon Harness MTB Connections

Side	Wire Color	Signal	Termiinal Position
Front	Brown	+	X1/34B-1
	Blue	GND	X1/1-3
Rear	Brown	+	X1/34B-2
	Blue	GND	X1/1-4

3.14 SCISSOR ARMS

Limit Switches



1. Platform Stowed/Jacks Retract Limit Switch
2. High Drive Speed Cutout Limit Switch
3. Max Drive Height/Max Height without Outriggers Limit Switch
4. Max Height Limit Switch
5. Cam 1
6. Cam 2
7. Cam 3
8. Cam 4

Figure 3-36. Limit Switch Adjustment

Cam Adjustment:

1. Adjust Cam 1 (5) to activate Platform Stowed/Jacks Retract Limit Switch (1) when platform is completely stowed.
2. Adjust Cam 2 (6) to activate High Drive Speed Cut-out Limit Switch (2) when platform is at a height of 12.1 ft (3.7 m).
3. Adjust Cam 3 (7) to activate Max Drive Height/Max Height without Outriggers Limit Switch (3) when platform is at a height of 65 ft (20 m).
4. Adjust Cam 4 (8) to activate Max Height Limit Switch (4) when platform exceeds a height of 68.9 ft (21 m).

NOTE: *The limit switch plate can be removed by removing the bolts, washers and nuts at each end of the mounting plate.*

Scissor Arm Assembly Removal

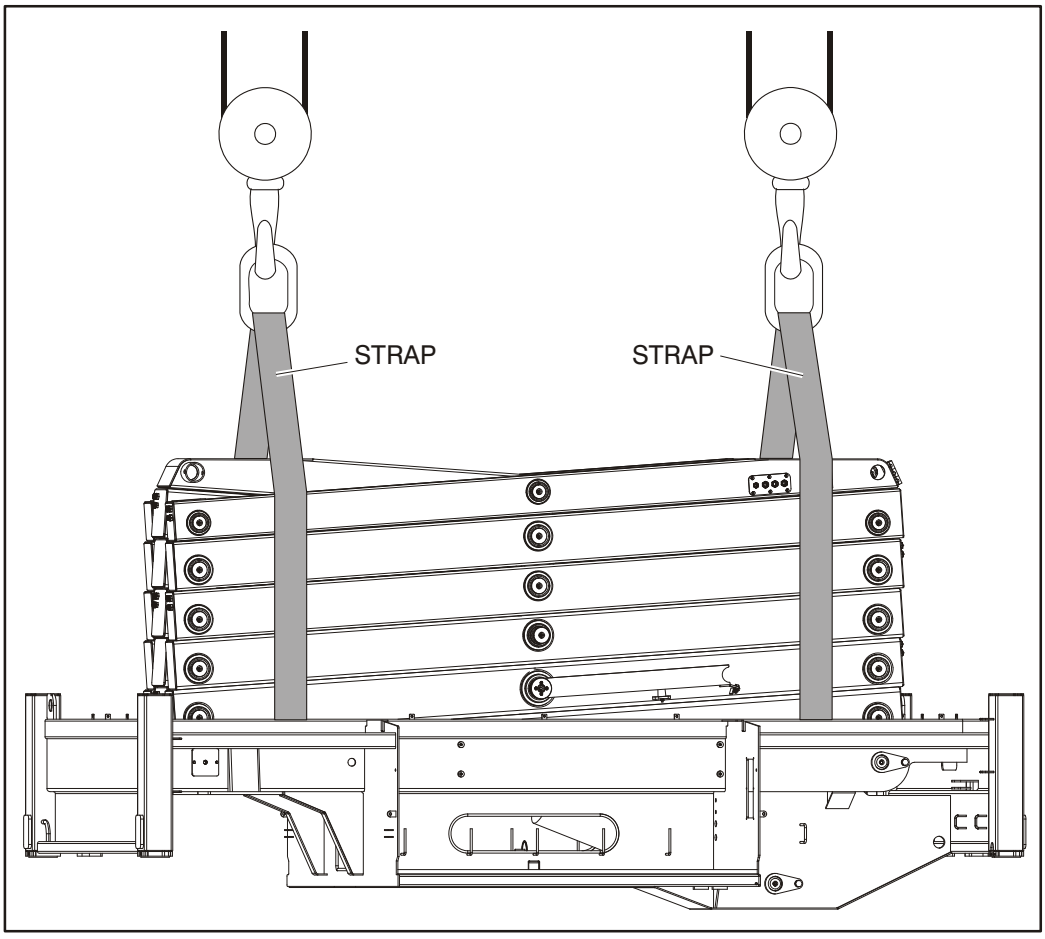
⚠ WARNING

EXTREME CAUTION MUST BE USED WHILE REMOVING ANY LARGE COMPONENTS. THESE COMPONENTS ARE EXTREMELY HEAVY AND CAN CAUSE SERIOUS INJURY OR DEATH IF NOT REMOVED CAUTIOUSLY.

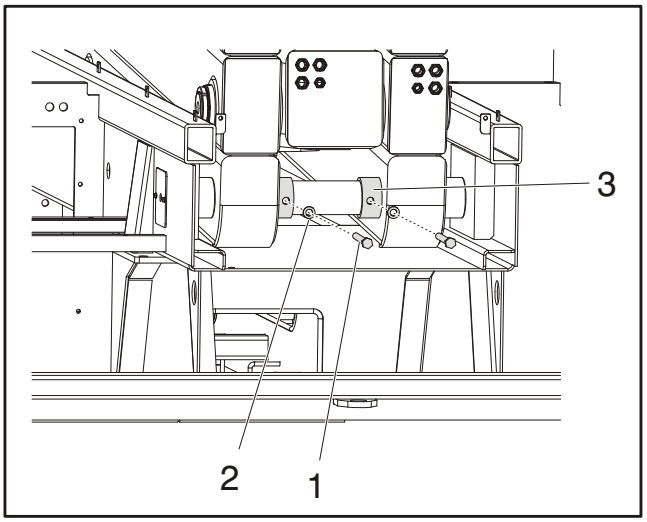
NOTE: *It is recommended to remove the scissor arm assembly as a whole unit.*

1. Remove the platform from the scissor arm assembly (refer to Figure 3-32., Platform Removal - 1 of 2 (Front of Platform) and Figure 3-33., Platform Removal - 2 of 2 (Rear of Platform)).
2. Disconnect all hoses and wires connecting the scissor assembly to the chassis and platform.
3. Secure scissor arm assembly with two lifting straps attached to an overhead lifting device.

NOTE: *Scissor arm assembly weighs approximately 15,653 lbs (7100 kg). Straps and lifting device must be capable of lifting the scissor assembly.*

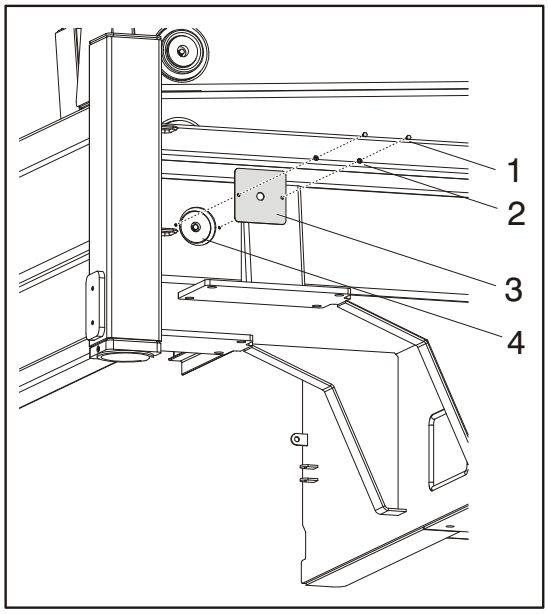


4. Remove one pin from the steering linkage to gain access to the scissor arms pin behind the wheel. (see Section 3-6., Steering Assembly).
5. Remove the cable from the ground control socket in the valve compartment.Remove the hydraulic hoses for the platform extension (Refer to Figure 4-37., Main Valve Block). Cap the fittings and secure the cable and hoses to the arm stack with tape. As soon as possible, brace the lift cylinder so that when it is disconnected from the arm stack it will be secured and will not fall.
6. Remove the Bolts (1), Flatwashers (2), and Locknuts (4) on the bottom arm pin at the rear of the machine.



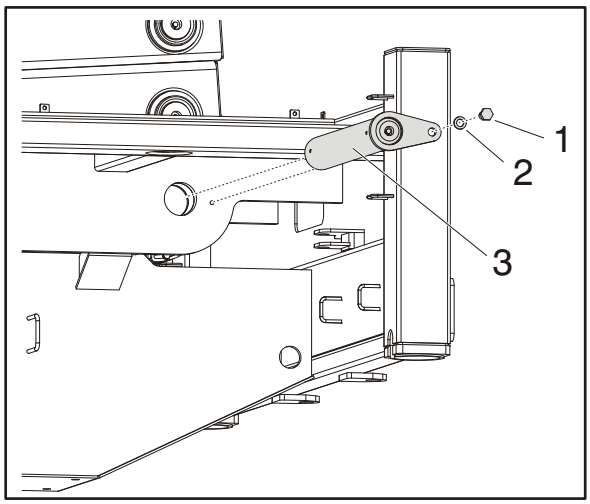
1. Bolt, M16 x 140mm
2. Flatwasher, M16
3. Spacer
4. Locknut, M16 (not shown)

7. Slightly lift the scissor stack up with the overhead crane so that the rear sliding blocks in the chassis are free.
8. Remove the Coverplates (3) from both sides of the machine by removing the two Bolts (1) and Lockwashers (2). Once the coverplates are removed the Pin (4) can be pushed out.



1. Bolt, M6 x 10mm
2. Lockwasher, M6
3. Coverplate
4. Pin

9. Remove the plate with the limit switches attached. (refer to Figure 3-36., Limit Switch Adjustment)
10. Remove the bottom arm Pin (3) at the front of the machine by removing the Bolt (1) and Lockwasher (2). Pull the Pin out and secure it to the chassis.



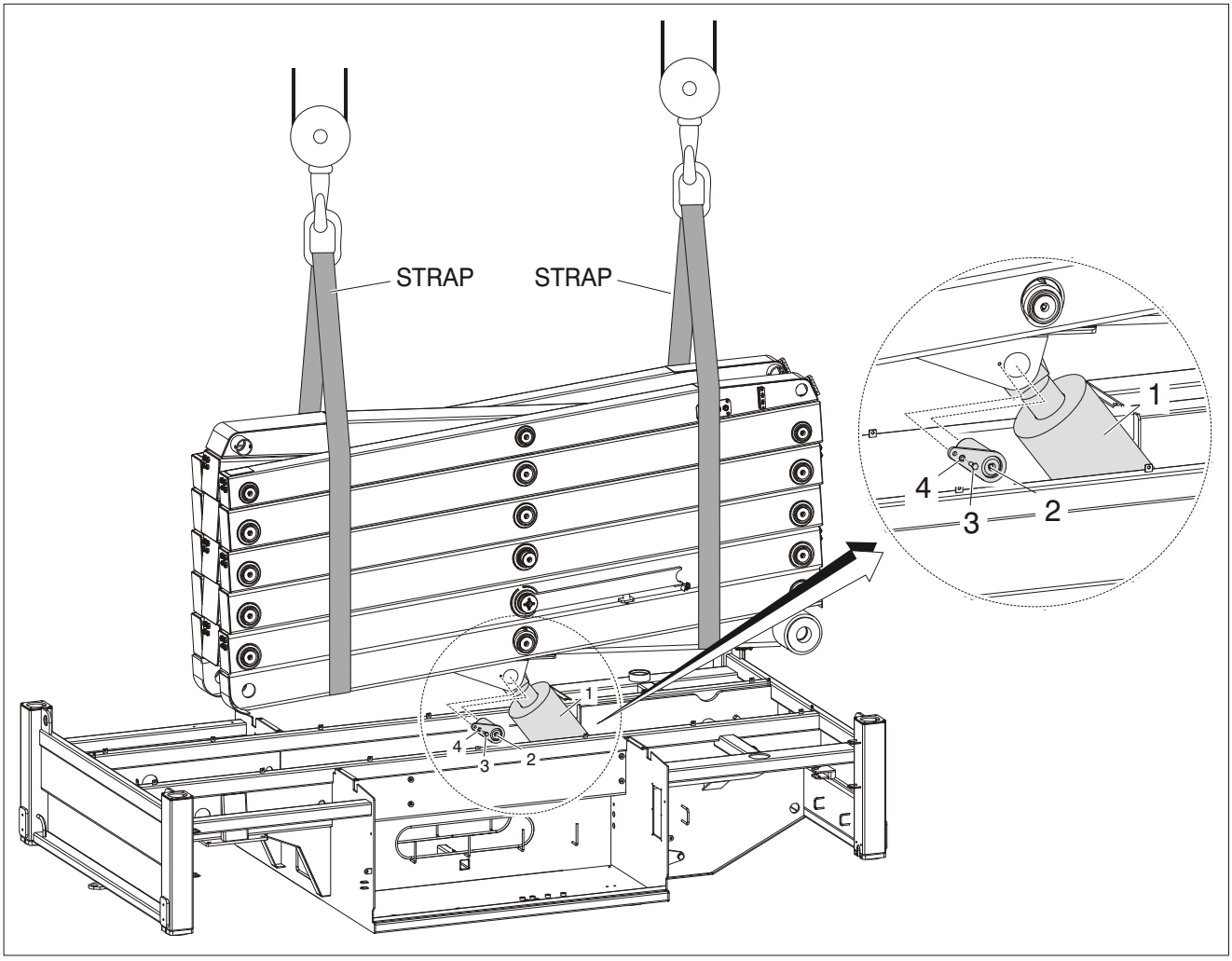
1. Bolt, M20 x 34mm
2. Lockwasher, M20
3. Pin

11. Lift the arm stack up and to the front. The lift cylinder (1) is still attached to the chassis and the arm stack will pivot about the Pin (2). When sufficient clearance is achieved between the lift cylinder and frame, secure the cylinder.

NOTICE

NEVER EXTEND THE LIFT CYLINDER WHEN THERE IS NO LOAD ON THE CYLINDER. THE CYLINDER IS SINGLE ACTING AND WILL HAVE NO MEANS OF RETRACTING.

12. Disconnect the Lift Cylinder from the arm stack by removing the Bolt (3) and Lockwasher (4). Pull out the Pin (2).



1. Lift Cylinder
2. Pin
3. Bolt, M20 x 35mm
4. Lockwasher, M20

13. The arm stack can now be moved away from the machine. Place the arm stack in a holding device or on secure blocks.

NOTE: *Follow the removal steps in reverse order when installing the arm assembly.*

Lift Cylinder Removal

⚠ WARNING

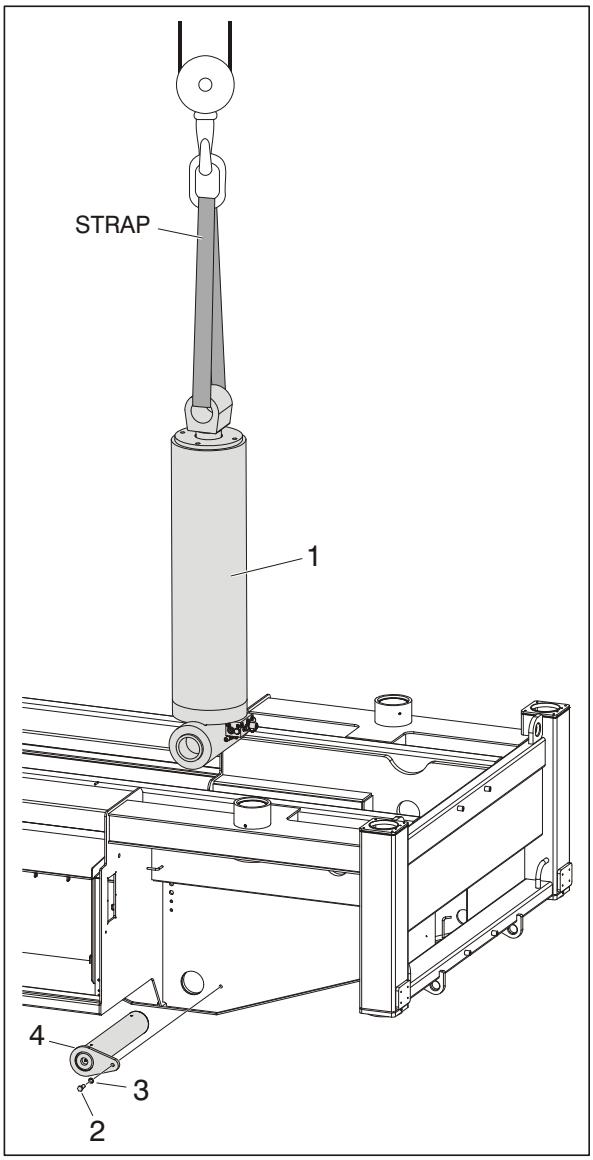
USE CAUTION WHEN REMOVING AND MOVING THE LIFT CYLINDER. THE LIFT CYLINDER ASSEMBLY WEIGHS APPROXIMATELY 992 LBS (450 KG). USE APPROPRIATE LIFTING DEVICES.

1. Follow the procedures on the previous pages to remove the platform and scissor arm assemblies.
2. Shutoff flow of hydraulic fluid by closing the shutoff levers on the hydraulic tank (see Figure 3-20.). Remove all hoses and/or wires from the Lift Cylinder (1).

NOTICE

MAKE SURE THE FITTING ON THE LEAK OIL LINE IS CLOSED TO PREVENT EXTENSION OF THE CYLINDER WHILE LIFTING FROM THE MACHINE.

3. Place a strap, attached to an overhead lifting device, through the top portion of the lift cylinder to secure the cylinder.
4. Put the cylinder into a vertical position with the overhead lifting device.
5. Remove the Bolt (2) and Lockwasher (3). Pull the Pin (4) out of the machine.
6. Carefully raise the Lift Cylinder (1) from the chassis using an overhead crane or other suitable lifting device..



1. Lift Cylinder
2. Bolt, M20 x 35mm
3. Lockwasher, M20
4. Pin

Figure 3-37. Lift Cylinder Removal

NOTE: *Follow the removal procedures in reverse order when installing the lift cylinder.*

Scissor Arms Disassembly

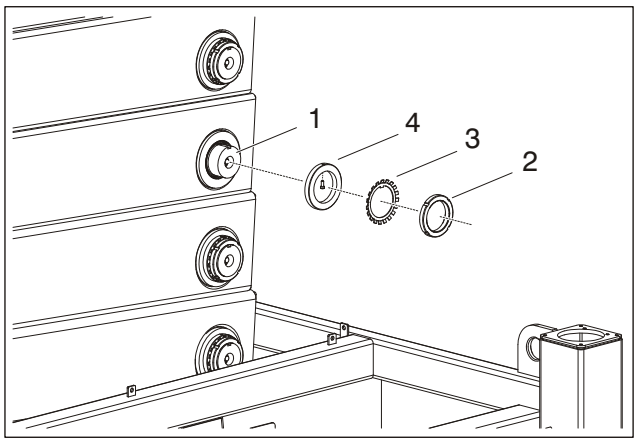
⚠ CAUTION

INDIVIDUAL SCISSOR ARMS ARE HEAVY. USE CAUTION WHEN REMOVING. USE APPROPRIATE LIFTING DEVICES.

1. Disconnect battery and shutoff flow of hydraulic fluid by closing the shutoff levers on the hydraulic tank (see Figure 3-20.).
2. Remove Platform (see Figure 3-32., Platform Removal - 1 of 2 (Front of Platform) and Figure 3-33., Platform Removal - 2 of 2 (Rear of Platform)).
3. Hydraulic lines and electrical lines run through the insides of the scissor arms. These hoses and wires must be removed before removing the arm components.
4. Brace the Scissor Arm Assembly as well as the individual Scissor Arm(s) being removed.

NOTE: *The below steps apply to each scissor arm pin.*

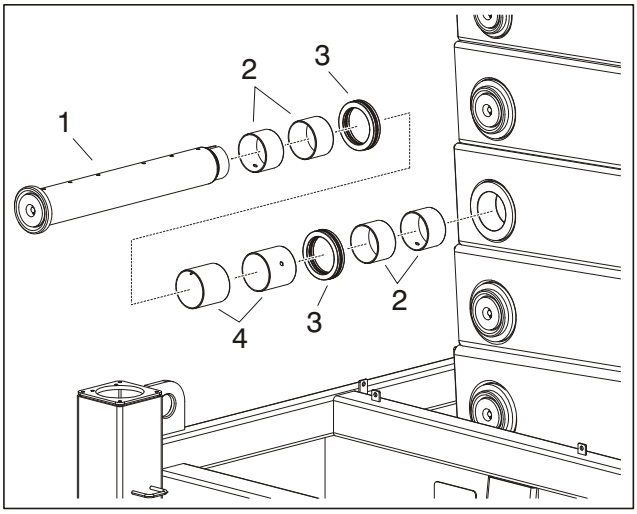
5. On the left side of the machine, remove the Nut (2) with a spanner wrench. Next remove the Retaining Washer (3) and Washer and Pin (4).



1. Arm Pin (75mm, 90mm, 110mm, or 130mm)
2. Nut (80mm or 100mm)
3. Retaining Washer (60mm, 80mm, or 100mm)
4. Washer & Pin

Figure 3-38. Scissor Arm Removal (Left Side)

6. Move to the right side of the machine. The Arm Pin (1) can now be pulled out of the scissor arm stack. Remove the four Bushings (2), two Ball Thrust Bearings (3), and two Bushings (4).



1. Arm Pin (75mm, 90mm, 110mm, or 130mm)
2. Bushing (75 x 60mm, 90 x 60mm, 110 x 60mm, or 130 x 60mm)
3. Ball Thrust Bearing
4. Bushing (75 x 80mm, 90 x 100mm, 110 x 110mm, or 130 x 100mm)

Figure 3-39. Scissor Arm Removal (Right Side)

7. Repeat steps 4 and 5 at each Arm Pin in order to remove the individual scissor arm.
8. Carefully lift the arm from the assembly.

NOTE: *Follow the removal steps in reverse order when installing the scissor arms.*

Tighten the Lock Nuts until there is zero clearance between the arms and the bearings. Back off one quarter of a revolution. Bend the lip on the corresponding Retaining Washer into the notch on the lock nuts.

NOTES:

SECTION 4. HYDRAULICS

4.1 CYLINDERS - THEORY OF OPERATION

Deck Extension Cylinder:

The deck is extended and retracted by means of a double acting cylinder controlled by the first section in the main control valve (see Figure 4-37., Main Valve Block). The service line relief valve in the control valve is set at 1160 psi (80 bar) for extend and 3046 psi (210 bar) for retract.

Lift Cylinder:

The lift cylinder is a single acting cylinder incorporating dual solenoid holding valves and a pilot operated check valve for emergency lowering. The lifting function is controlled by the 3rd section of the main control valve. Lift speed is limited by flow from section 1 in the pump.

Lowering is operated by energizing the 2 solenoid holding valves together with the 3rd section of the main control valve. Descent speed is controlled by an adjustable line mounted flow control valve.

To enable lowering at full speed when the engine is stopped (i.e. there is no hydraulic power available to act as a pilot supply for the electrical actuator), a pilot line is connected to the auxiliary port "M" on the control valve via a check valve. This provides the hydraulic power necessary to shift the lower valve section.

Outrigger Cylinders:

The automatic self leveling system is controlled by 4 double acting cylinders mounted at each corner of the machine chassis. These cylinders incorporate pilot operated holding valves on the piston side. The cracking pressure of these valves is 15 psi (1 bar) for the rear and 116 psi (8 bar) for the front.

Steer Cylinder:

Steering is controlled by a double acting cylinder connected to the 4th section of the main control valve.

4.2 VALVES - THEORY OF OPERATION

Solenoid Control Valves (Bang-Bang)

Control valves used are four-way three-position solenoid valves of the sliding spool design. When a circuit is activated and the control valve solenoid energizes, the spool is shifted and the corresponding work port opens to permit oil flow to the component in the selected circuit, with the opposite work port opening to reservoir. Once the circuit is deactivated (control returned to neutral), the valve spool returns to neutral (center) and oil flow is then directed through the valve body and returns to reservoir. A typical control valve consists of the valve body, sliding spool, and two solenoid assemblies. The spool is machine fitted in the bore of the valve body. Lands on the spool divide the bore into various chambers, which, when the spool is shifted, align with corresponding ports in the valve body open to common flow. At the same time other ports would be blocked to flow. The spool is spring-loaded to center position, therefore when the control is released, the spool automatically returns to neutral, prohibiting any flow through the circuit.

Relief Valves

Main relief valves are installed at various points within the hydraulic system to protect associated systems and components against excessive pressure. Excessive pressure can be developed when a cylinder reaches its limit of travel and the flow of pressurized fluid continues from the system control. The relief valve provides an alternate path for the continuing flow from the pump, thus preventing rupture of the cylinder, hydraulic line or fitting. Complete failure of the system pump is also avoided by relieving circuit pressure. The relief valve is installed in the circuit between the pump outlet (pressure line) and the cylinder of the circuit, generally as an integral part of the system valve bank. Relief pressures are set slightly higher than the load requirement, with the valve diverting excess pump delivery back to the reservoir when operating pressure of the component is reached.

Crossover Relief Valves

Crossover relief valves are used in circuits where the actuator requires an operating pressure lower than that supplied to the system. When the circuit is activated and the required pressure at the actuator is developed, the crossover relief diverts excess pump flow to the reservoir. Individual, integral relief's are provided for each side of the circuit.

Proportional Valve

Flow is proportional to the amount of voltage supplied to the valve coil. Voltage is gained by the machine controller and determined by the position of the joystick.

4.3 CYLINDER CHECKING PROCEDURE

NOTE: *Cylinder check must be performed anytime a system component is replaced or when improper system operation is suspected.*

1. Using all applicable safety precautions, activate engine and fully extend cylinder to be checked. Shut down engine.
2. Carefully disconnect hydraulic hoses from retract port of cylinder. There will be some initial weeping of hydraulic fluid which can be caught in a suitable container. After the initial discharge, there should be no further drainage from the retract port.
3. Activate engine and extend cylinder.
4. If cylinder retract port leakage is less than 6-8 drops per minute, carefully reconnect hose to port and retract cylinder. If leakage continues at a rate of 6-8 drops per minute or more, cylinder repair must be made.
5. With cylinder fully retracted, shut down engine and carefully disconnect hydraulic hose from cylinder extend port.
6. Activate engine and retract cylinder. Check extend port for leakage.
7. If extend port leakage is less than 6-8 drops per minute, carefully reconnect hose to extend port, then activate cylinder through one complete cycle and check for leaks. If leakage continues at a rate of 6-8 drops per minute or more, cylinder repairs must be made.

4.4 CYLINDER REPAIR

NOTE: *The following are general procedures that apply to all of the cylinders on this machine. Procedures that apply to a specific cylinder will be so noted. Refer to Figures 4-26 thru 4-30 for specific cylinder assembly breakdowns and for specific parts references. Refer to JLG Parts Manual 3121326 for seal kits and part numbers.*

Disassembly

⚠ WARNING

BEFORE REMOVING CYLINDERS FROM THE MACHINE, BE SURE TO SUPPORT THE MACHINE AND SCISSOR ARMS/PLATFORM WITH SAFETY PROPS, FORKLIFTS, OR OVERHEAD CRANE TO PREVENT RELEVANT COMPONENTS FROM COLLAPSING AND CAUSING SERIOUS INJURY OR DEATH. (SEE FIGURE 4-31.)

NOTICE

DISCONNECT THE BATTERIES BEFORE REMOVING ANY COMPONENTS FROM THE CYLINDER ASSEMBLY.

1. Remove cylinder(s) from the machine by first disconnecting all hoses and/or wires and any valves. Next, unscrew bolts connecting cylinder(s) to the machine. If applicable, remove any pins connecting the cylinders to the machine.

NOTE: *Step 2 applies only to the Lift Cylinder.*

2. To prevent damage, remove the valve block from the lift cylinder barrel by unscrewing the 4 set screws.

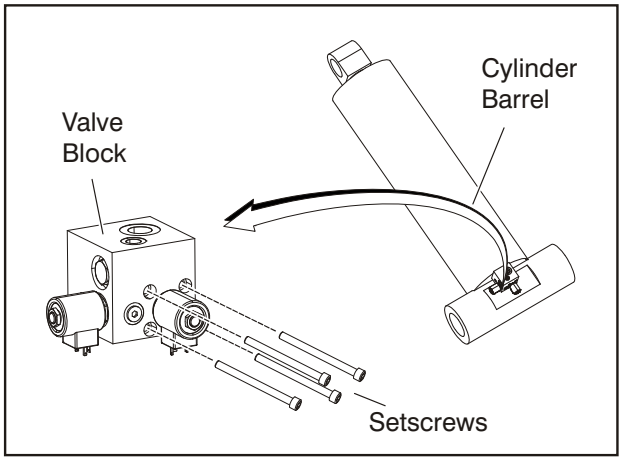


Figure 4-1. Lift Cylinder Valve Block Removal

NOTE: *Step 3 applies only to the Axle Lockout Cylinder.*

3. To prevent damage, remove the load check valve from the barrel.

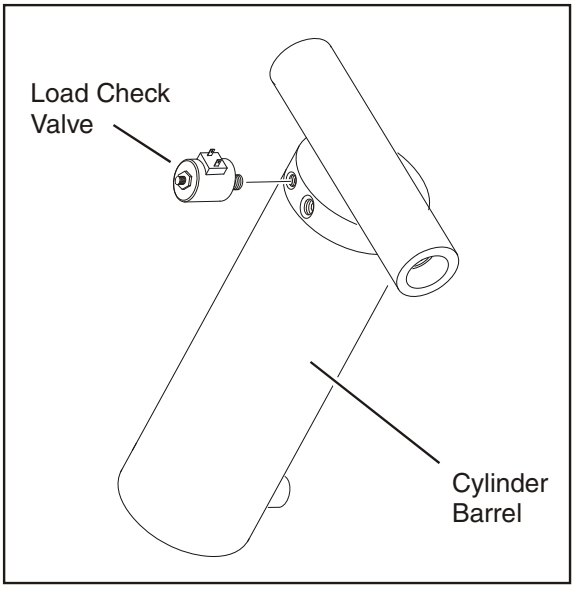


Figure 4-2. Load Check Valve Romoval

NOTE: *Step 4 applies only to the Outrigger Cylinders.*

4. To prevent damage, remove the safety valve and limit switch from the top of the outrigger cylinders.

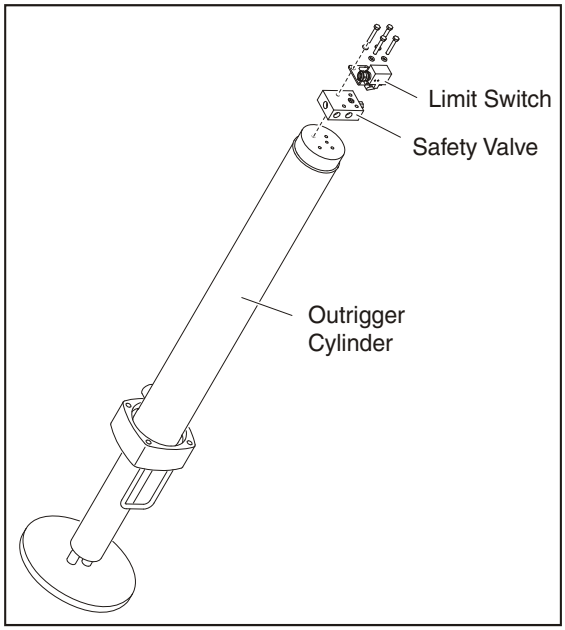


Figure 4-3. Safety Valve and Limit Switch Removal

NOTICE

DISASSEMBLY OF THE CYLINDER SHOULD BE PERFORMED ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA.

5. Connect a suitable auxiliary hydraulic power source to the cylinder port block fitting.

⚠ WARNING

DO NOT FULLY EXTEND CYLINDER TO THE END OF STROKE. RETRACT CYLINDER SLIGHTLY TO AVOID TRAPPING PRESSURE.

6. Operate the hydraulic power source and extend the cylinder. Shut down and disconnect the power source.
7. Adequately support the cylinder rod, if applicable.
8. Place the cylinder barrel into a suitable holding fixture.

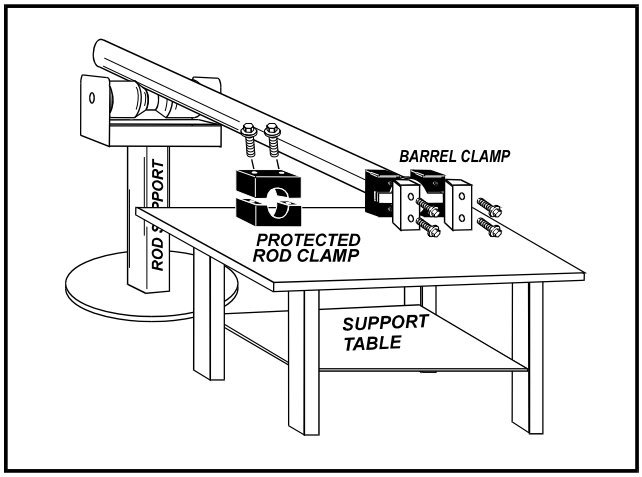


Figure 4-4. Cylinder Barrel Support

9. Using a spanner wrench, loosen and remove the cylinder head from the barrel.

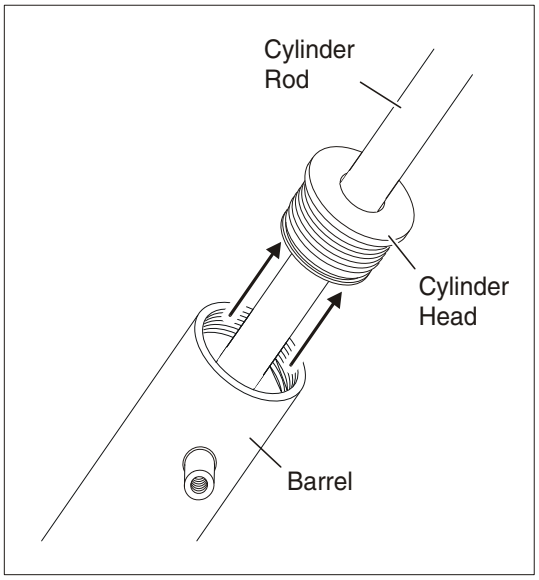


Figure 4-5. Cylinder Head Removal

NOTICE

EXTREME CARE SHOULD BE TAKEN WHEN REMOVING THE CYLINDER ROD, HEAD, AND PISTON. AVOID PULLING THE ROD OFF-CENTER, WHICH COULD CAUSE DAMAGE TO THE PISTON AND CYLINDER BARREL SURFACES.

10. With the barrel clamped securely, apply pressure to the rod pulling device and carefully withdraw the complete rod assembly from the cylinder barrel.

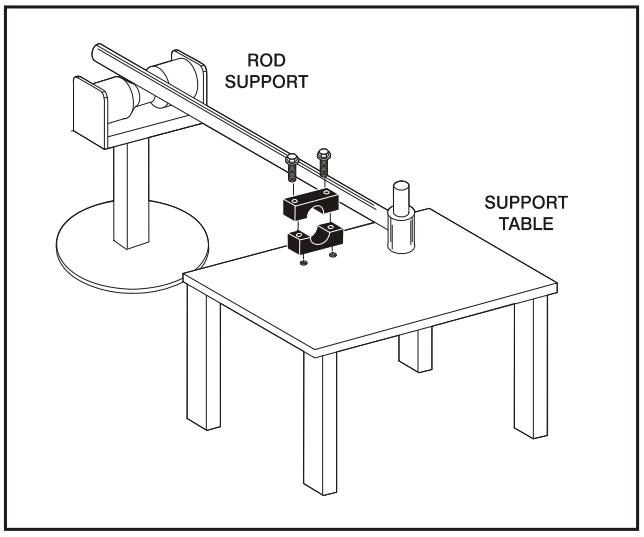


Figure 4-6. Cylinder Rod Support

11. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston as possible.

12. If applicable, loosen and remove the setscrew which attaches the piston to the rod, and remove the piston.

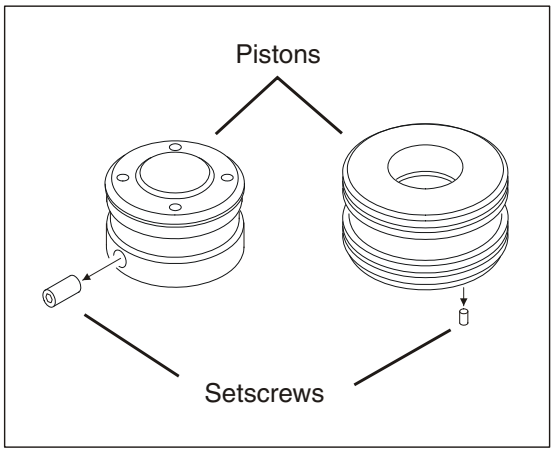


Figure 4-7. Piston Setscrew Removal

13. If applicable, unscrew the piston counter-clock-wise, by hand, and remove the piston from the cylinder rod.

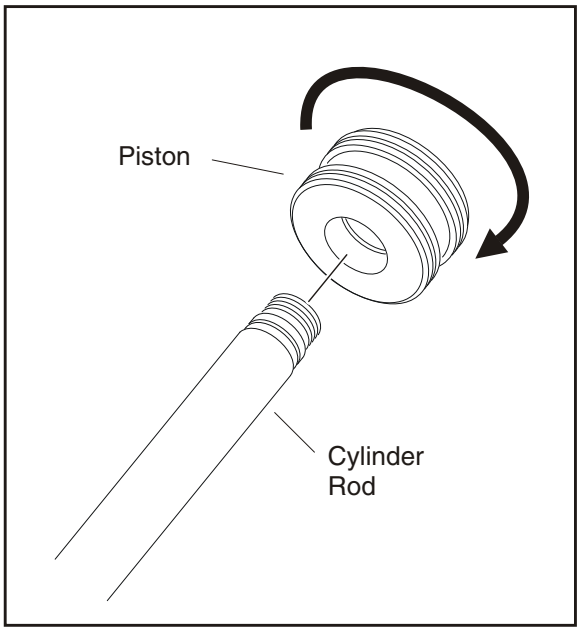


Figure 4-8. Piston Removal

14. Remove and discard the piston o-rings, seal rings, and, if applicable, the snap ring.

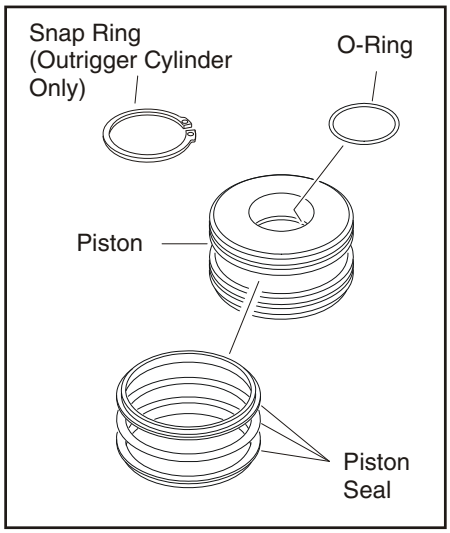


Figure 4-9. Piston Seals

15. If applicable, remove the spacer from the rod.

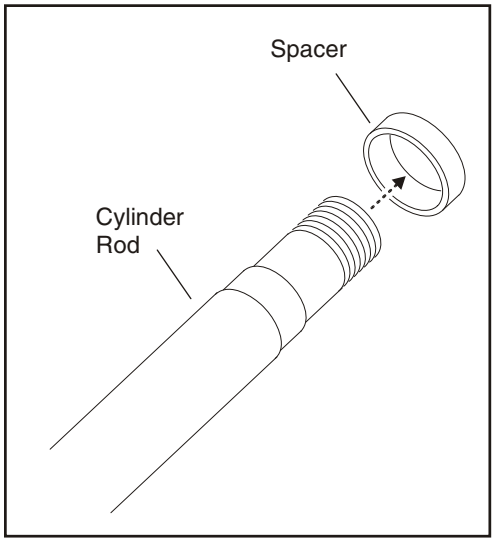


Figure 4-10. Spacer Removal

16. Remove the rod from the holding fixture.

17. Remove the cylinder head from the cylinder rod.

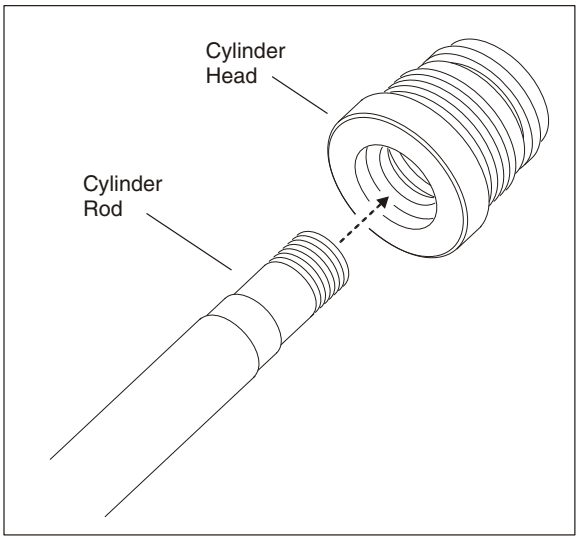


Figure 4-11. Cylinder Head Removal

18. If applicable, remove and discard the cylinder head seal, rod seal, wiper, o-ring(s), back-up ring, and snap ring.

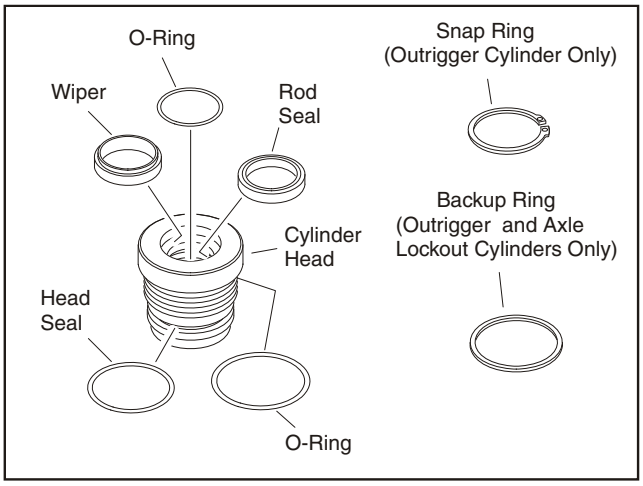


Figure 4-12. Cylinder Head Seals

Cleaning and Inspection

1. Clean all parts thoroughly in an approved cleaning solvent.
2. Inspect the cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
3. Inspect threaded portion of rod for excessive damage. Dress threads as necessary.
4. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
5. Inspect threaded portion of barrel for damage. Dress threads as necessary.
6. Inspect piston surface for damage and scoring and for distortion. Dress piston surface or replace piston as necessary.
7. If applicable, inspect threaded portion of piston for damage. Dress threads as necessary.
8. Inspect seal and o-ring grooves in piston for burrs and sharp edges. Dress applicable surfaces as necessary.
9. Inspect cylinder head inside diameter for scoring or other damage and for ovality and tapering. Replace as necessary.
10. Inspect threaded portion of head for damage. Dress threads as necessary.
11. Inspect seal and o-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
12. Inspect cylinder head outside diameter for scoring or other damage and ovality and tapering. Replace as necessary.
13. If applicable, inspect rod and barrel bushings for signs of excessive wear or damage. Replace as necessary.
    a. Thoroughly clean bushing housing, of burrs, dirt etc. to facilitate bearing installation.
    b. Inspect bushing housing for wear or other damage. If the bushing housing is worn or damaged, rod/barrel must be replaced.
    c. Lubricate inside of bushing housing with WD40 prior to bushing installation.
    d. Using an arbor of the correct size, carefully press the bushing(s) into bushing housing on the cylinder rod and cylinder barrel, if applicable.

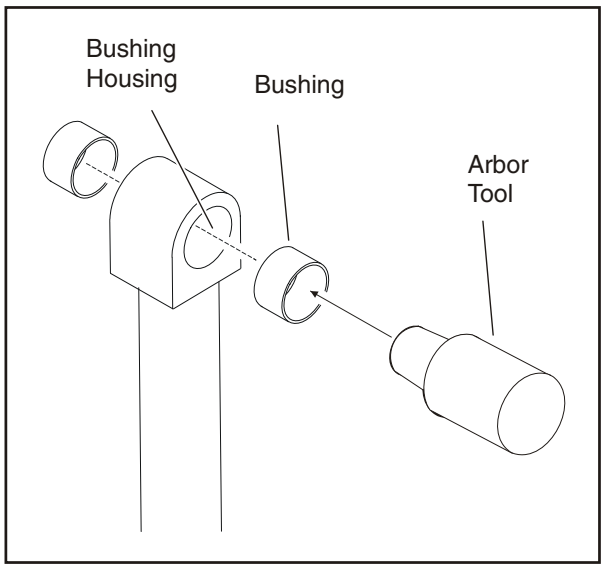


Figure 4-13. Bushing Installation

NOTE: *Step 14 applies only to the Lift Cylinder and Axle Lockout Cylinder.*

14. Inspect lift/lower valve and load check valve. Replace as necessary.
15. Inspect the oil ports for blockage or the presence of dirt or other foreign material. Repair as necessary.
16. If applicable, inspect piston rings for cracks or other damage. Replace as necessary.

Assembly

NOTE: *Prior to cylinder assembly, ensure that the proper cylinder seal kit is used. See your JLG Parts Manual 3121326. Always replace seals when servicing cylinders.*

Apply a light film of hydraulic oil to all components prior to assembly.

1. A special tool is used to install a new rod seal into the applicable cylinder head gland groove.

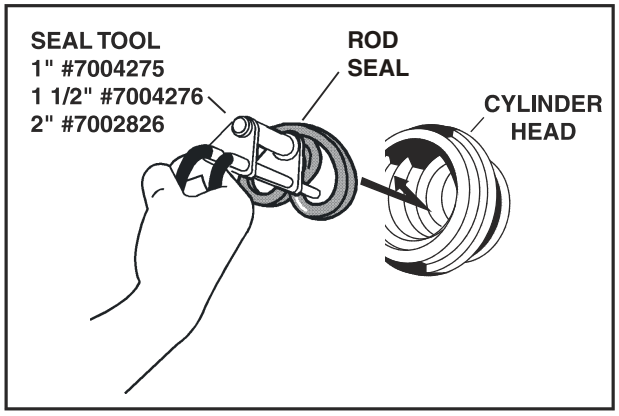


Figure 4-14. Rod Seal Installation

NOTICE

WHEN INSTALLING PISTON SEALS, ENSURE SEALS ARE INSTALLED PROPERLY. IMPROPER SEAL INSTALLATION COULD RESULT IN CYLINDER LEAKAGE AND IMPROPER CYLINDER OPERATION.

WHEN INSTALLING THE WIPER SEAL, APPLY LOCTITE #609 ON THE WIPER SEAL IN THREE EVENLY SPACED PLACES TO AID IN RETENTION OF THE SEAL.

2. Use a soft mallet to tap a new wiper seal into the applicable cylinder head gland groove. Install a new rod seal into the applicable cylinder head gland-groove.
3. Install a new head seal, new o-rings, and, if applicable, a new backup ring, in the appropriate outside diameter groove of the cylinder head.

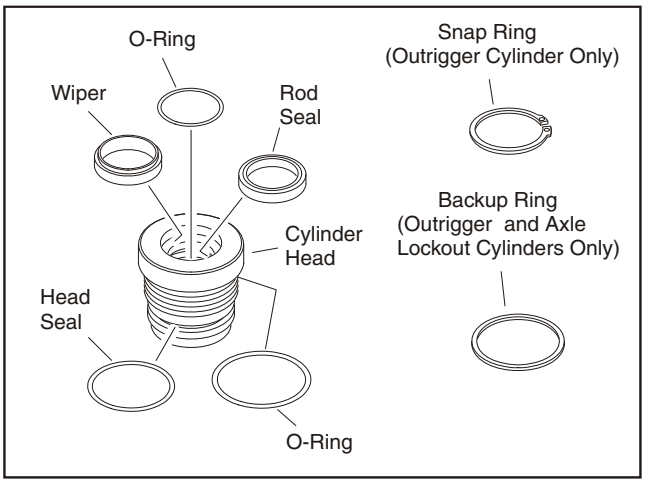


Figure 4-15. Cylinder Head Seal Installation

4. Carefully install the cylinder head on the rod, ensuring that the wiper, o-ring, and rod seals are not damaged or dislodged. Push the head along the rod to the rod end, as applicable.

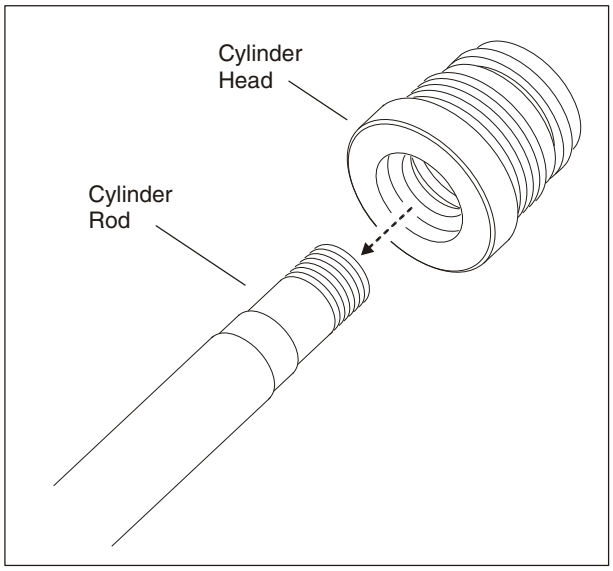


Figure 4-16. Cylinder Head Installation

5. Carefully slide the piston spacer onto the cylinder-rod.

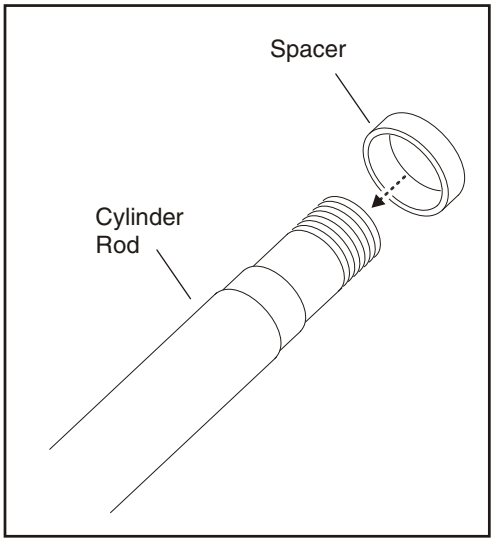


Figure 4-17. Spacer Installation

6. If applicable, correctly install new o-ring and snap ring in the inner piston diameter groove.

7. If applicable, correctly place new seals in the outer piston diameter groove(s). (A tube, with an inner diameter slightly larger than the outer diameter of the piston is recommended to install the solid seal.)

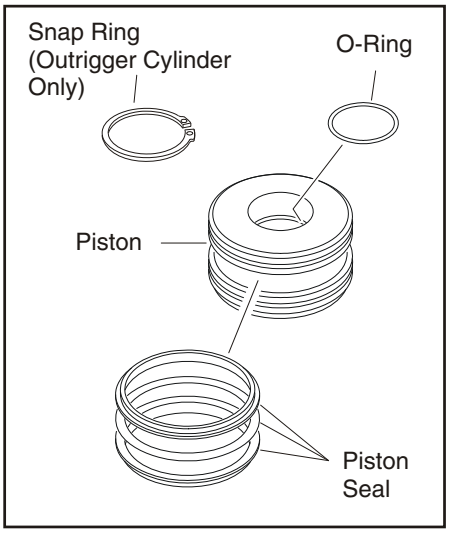


Figure 4-18. Piston Seal Installation

8. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston as possible.

9. If applicable, carefully thread the piston clock-wise on the cylinder rod hand tight until it abuts the spacer, ensuring that the o-ring, snap ring, and piston seals are not damaged or dislodged.

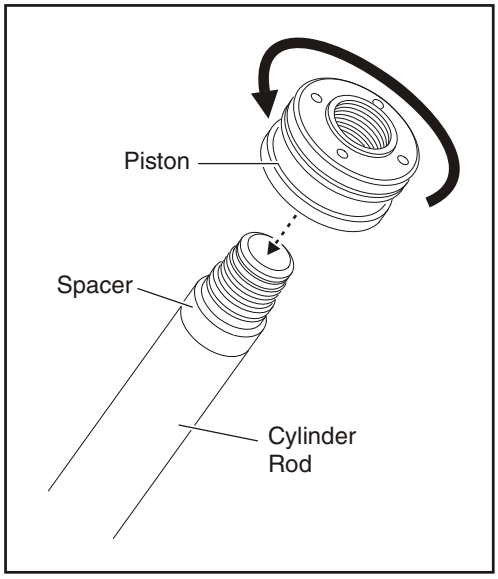


Figure 4-19. Piston Installation

10. If applicable, insert the setscrews on the piston and tighten to lock piston in place on cylinder rod.

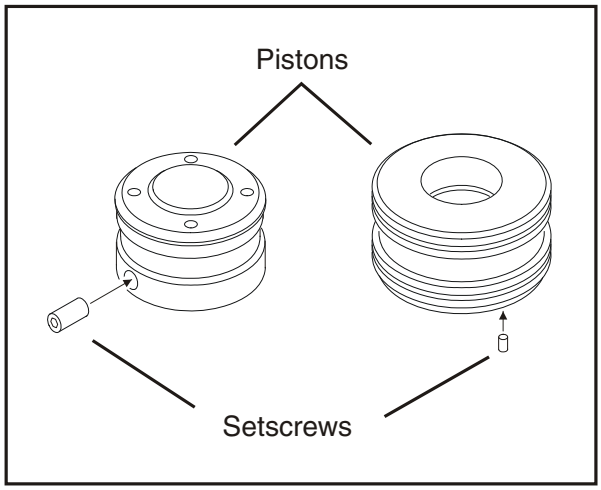


Figure 4-20. Piston Setscrew Installation

11. Remove the cylinder rod from the holding fixture.

12. Position the cylinder barrel in a suitable holding fixture.

NOTICE

EXTREME CARE SHOULD BE TAKEN WHEN INSTALLING THE CYLINDER ROD, HEAD, AND PISTON. AVOID PULLING THE ROD OFF-CENTER, WHICH COULD CAUSE DAMAGE TO THE PISTON AND CYLINDER BARREL SURFACES.

13. With the barrel clamped securely, and while adequately supporting the rod, insert the piston end into the barrel cylinder. Ensure that the piston loading o-ring and seal ring are not damaged or dislodged.

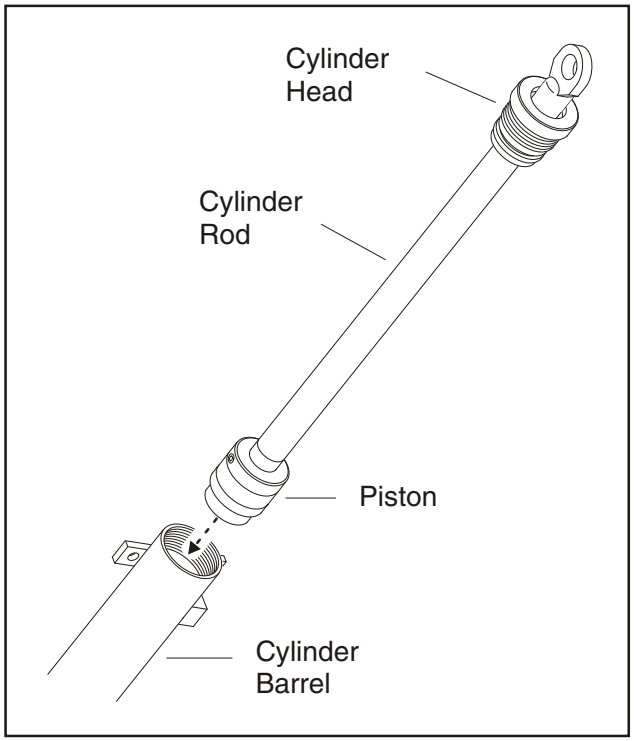


Figure 4-21. Rod Installation

14. Continue pushing the rod into the barrel until the cylinder head can be inserted into the barrel cylinder.

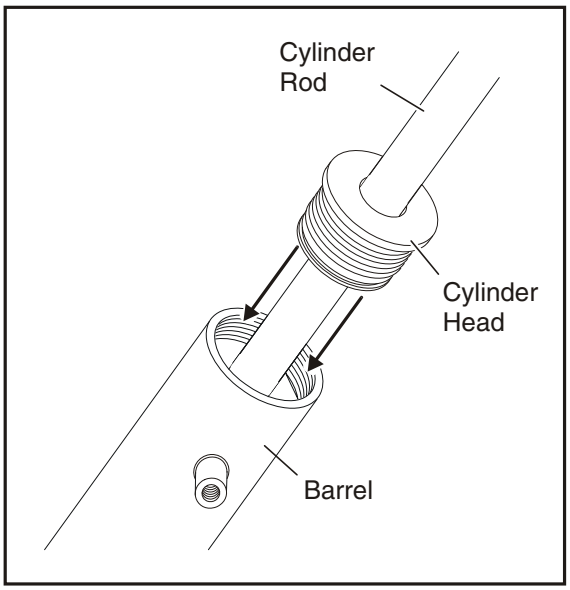
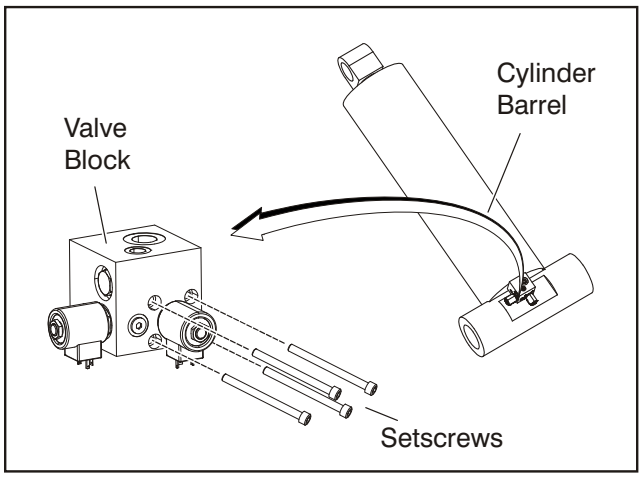


Figure 4-22. Rod Assembly Installation

15. Using a spanner wrench, tighten the cylinder head onto the barrel.

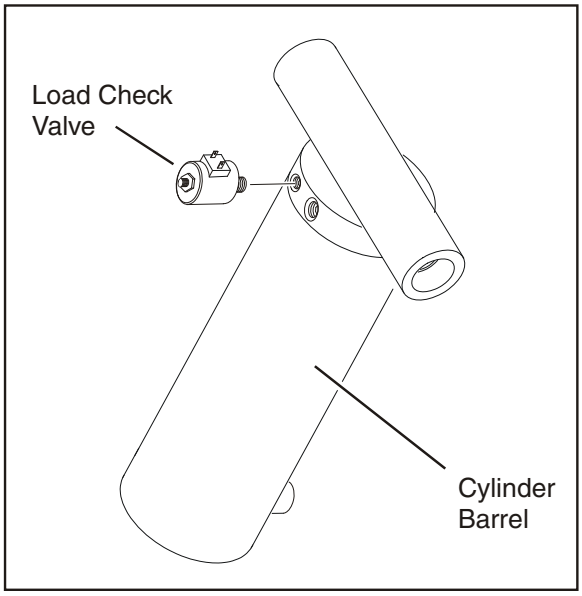
NOTE: *Steps 16 applies only the Lift and Axle Lockout Cylinders.*

16. If applicable, after the cylinder has been reassembled, the rod should be pushed all the way in (fully retracted) prior to the reinstallation of any valve block, load check valve, or safety valve.



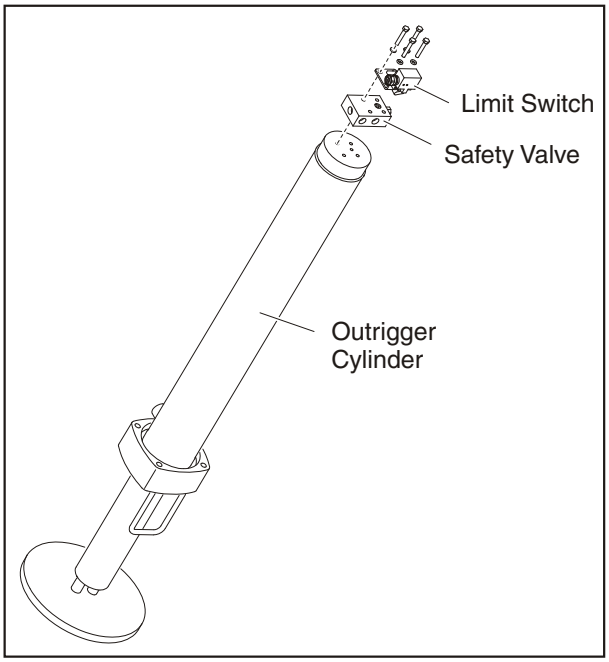
NOTE: *Lift Cylinder only.*

Figure 4-23. Valve Block Installation



NOTE: *Axle Lockout Cylinder only.*

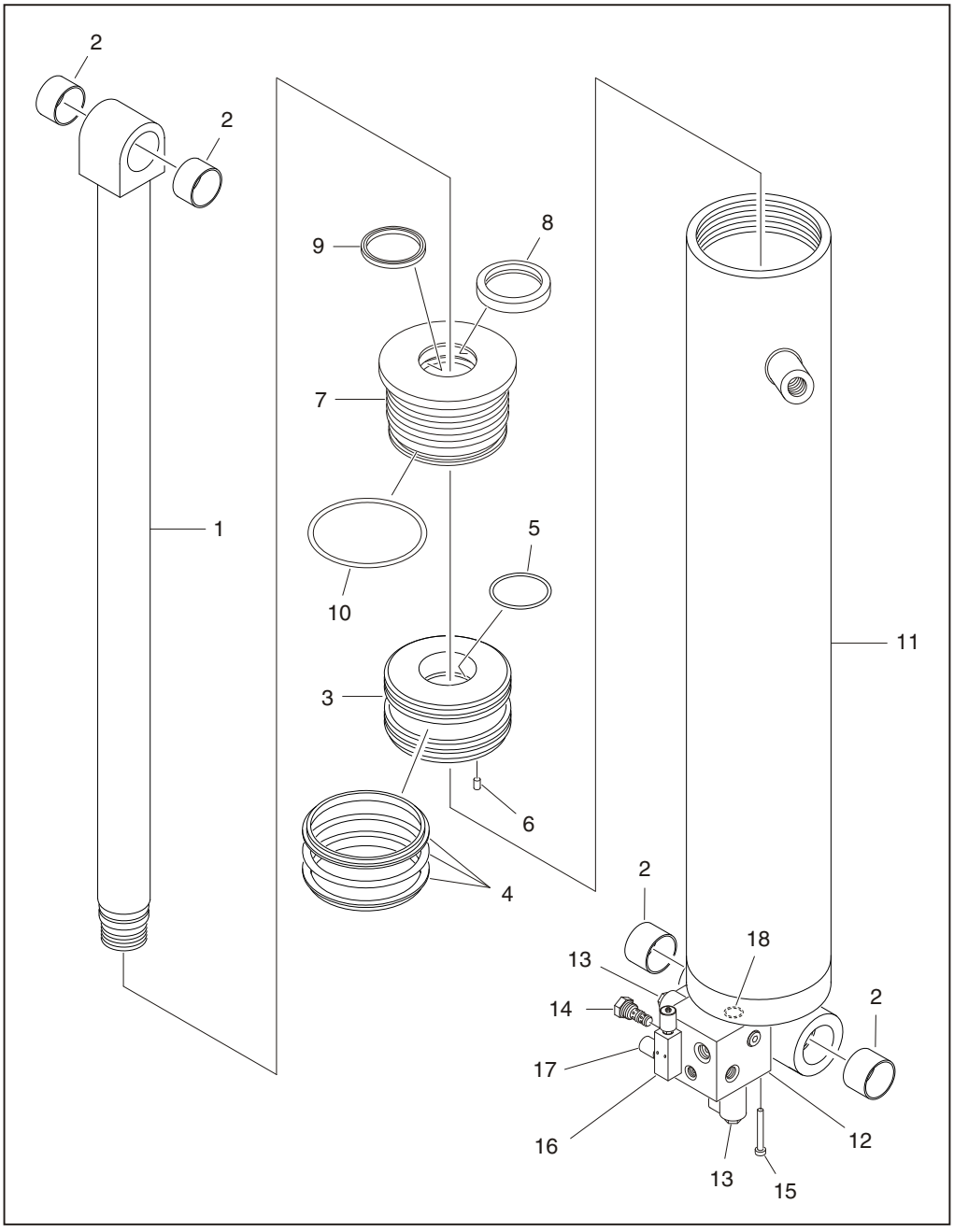
Figure 4-24. Load Check Valve Installation



NOTE: *Outrigger Cylinders only.*

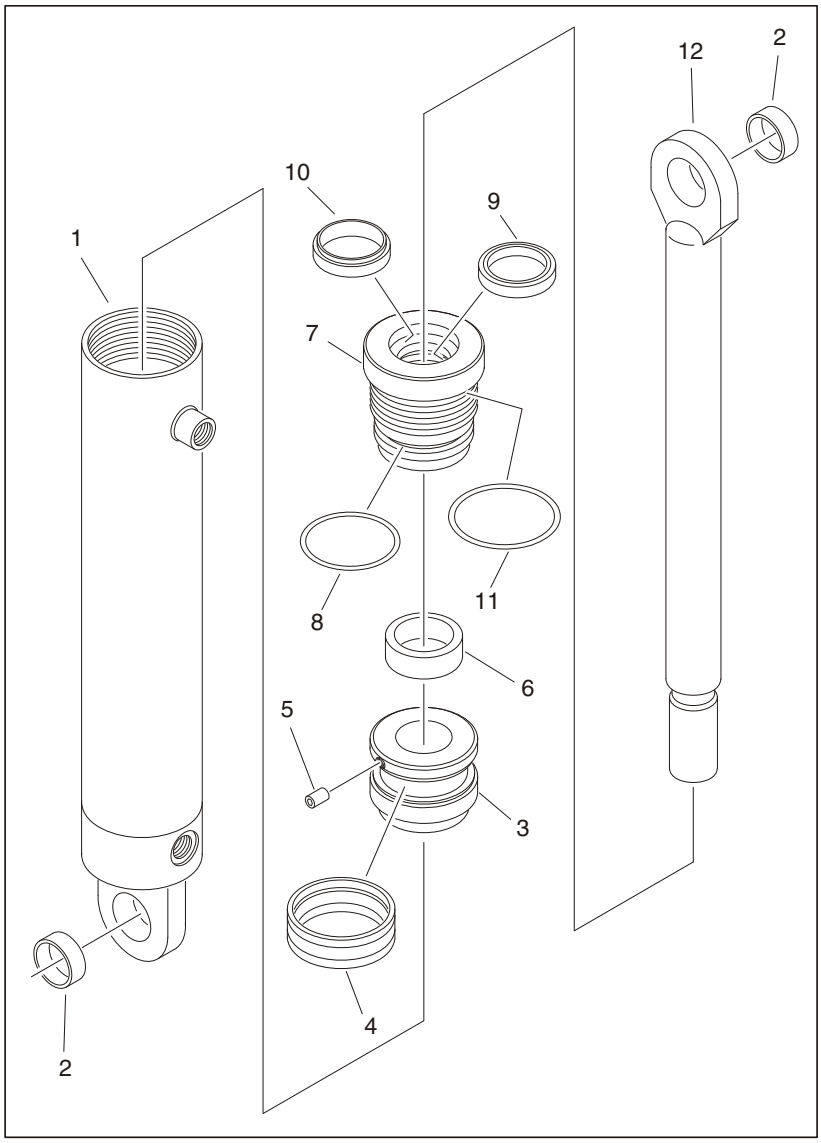
Figure 4-25. Safety Valve and Limit Switch Installation

NOTE: *Refer to Figure 1-3., Torque Chart (SAE Fasteners - Sheet 1 of 3) to Figure 1-8., Torque Chart (METRIC Fasteners - Sheet 3 of 3) for setscrew torques.*



1. Piston Rod
2. Bushing
3. Piston
4. Piston Seal
5. O-Ring
6. Setscrew
7. Cylinder Head
8. Wiper
9. Rod Seal
10. O-Ring
11. Cylinder Barrel
12. Lift/Lower Valve
13. Solenoid Valve
14. Check Valve
15. Capscrew (M8 x 120mm)
16. Hydraulic Block
17. Pressure Sensor
18. O-Ring

Figure 4-26. Lifting Cylinder Assembly

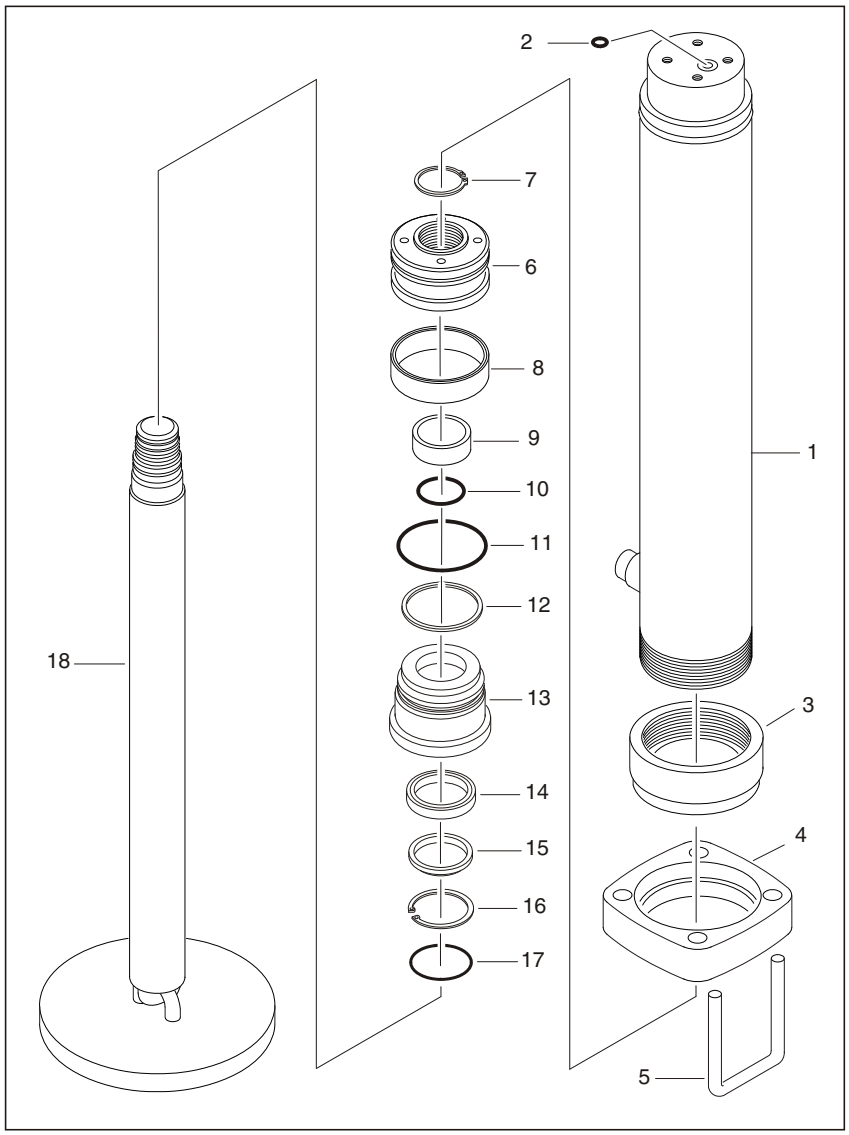


1. Barrel
2. Bushing
3. Piston
4. Piston Seal
5. Setscrew
6. Spacer
7. Head
8. Head Seal
9. Rod Seal
10. Wiper
11. O-Ring
12. Rod

Figure 4-27. Steering Cylinder Assembly

Table 4-1. Steer Cylinder Specs

Max Working Pressure	3045.7 psi (210 bar)
Piston Head Torque (Apply Loctite 242 before tightening)	191.8 lb ft (260 Nm)
Max Speed	1.6 ft/sec (0.5 m/sec)
Max Operating Temperature	-4°F to 176°F (-20°C to 80°C)

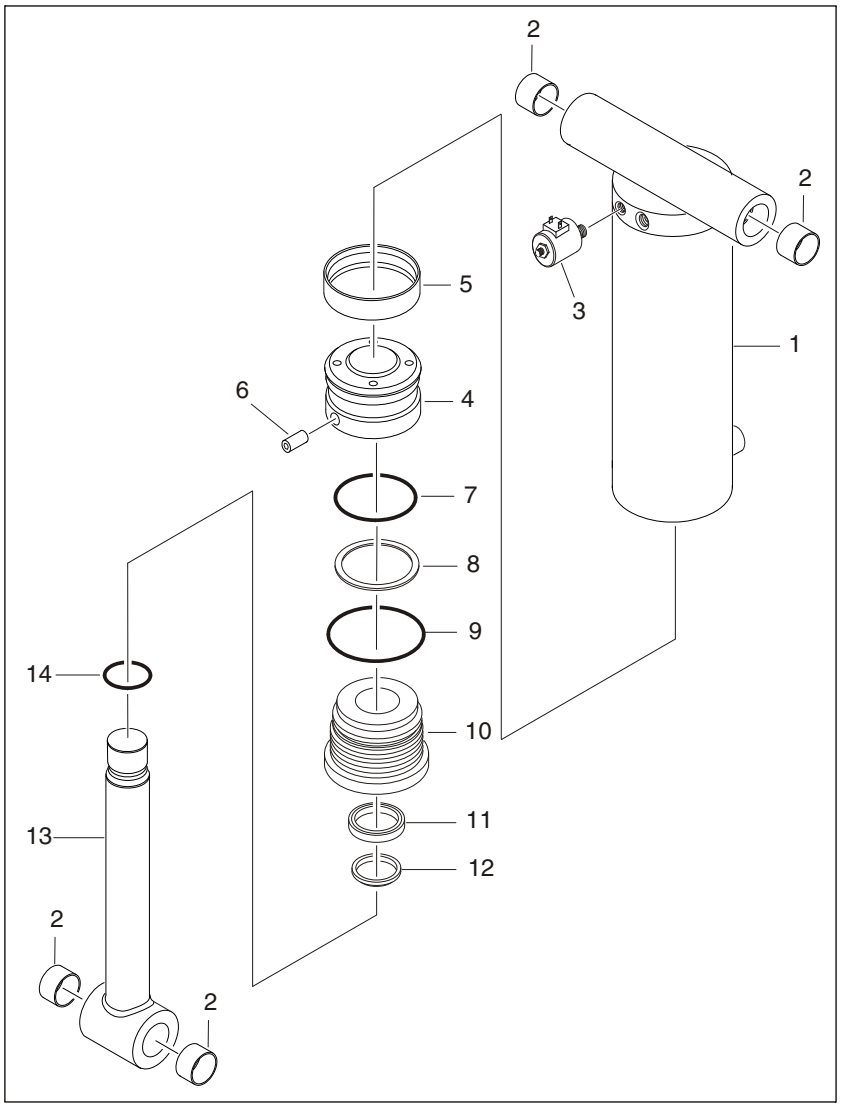


1. Barrel
2. O-Ring
3. Cap
4. Mounting Flange
5. Stop
6. Piston
7. Snap Ring
8. Piston Seal
9. Spacer
10. O-Ring
11. O-Ring
12. Back-up Ring
13. Head
14. Rod Seal
15. Wiper
16. Snap Ring
17. O-Ring
18. Rod Assembly

Figure 4-28. Outrigger Cylinder Assembly

Table 4-2. Outrigger Cylinder Specs

Max Working Pressure	2683.1 psi (185 bar)
Piston Head Torque (Apply Loctite 243 prior to tightening) (torque with Rod End)	737.6 lb ft (1000 Nm)
Cap Torque (Apply Circlip behind Piston Head prior)	958.8 lb ft (1300 Nm)
Max Speed	0.5 m/sec
Max Operating Temperature	-22°F to 212°F (-30°C to 100°C)

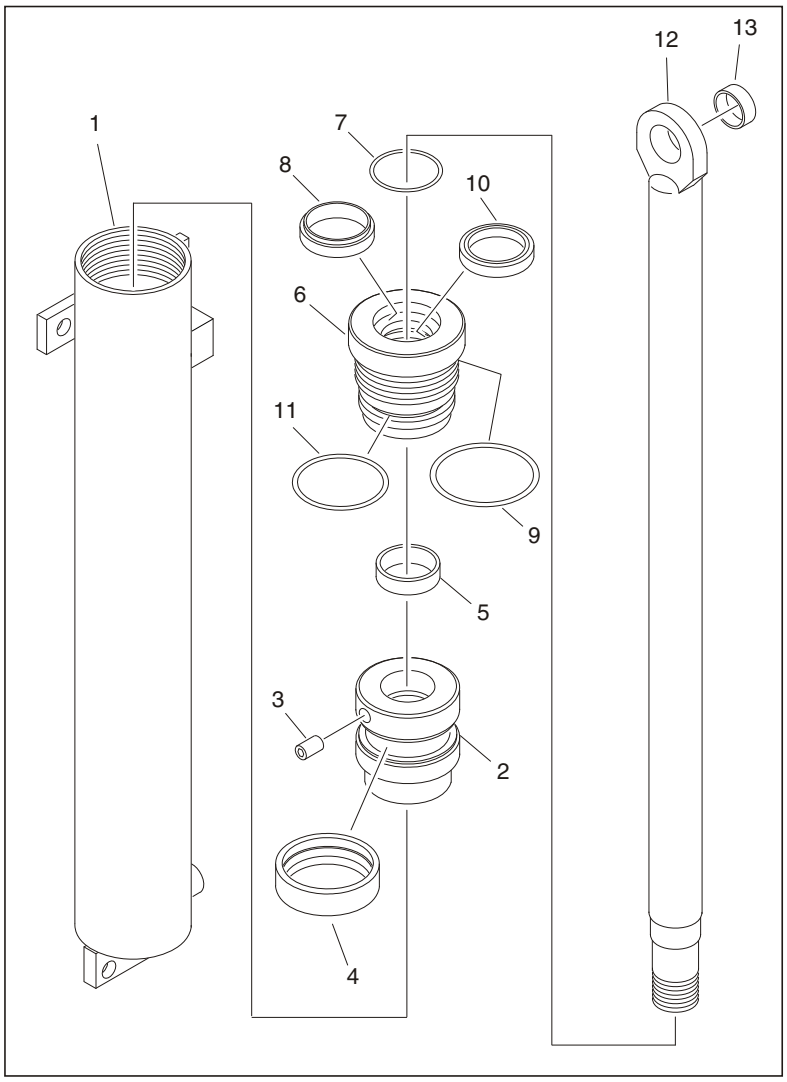


1. Barrel
2. Bushing
3. Load Check Valve
4. Piston
5. Piston Seal
6. Setscrew
7. Head Seal
8. Backup Ring
9. O-Ring
10. Head
11. Rod Seal
12. Wiper
13. Rod
14. O-Ring

Figure 4-29. Axle Locking Cylinder Assembly

Table 4-3. Axle Locking Cylinder Specs

Max Working Pressure	2900.7 psi (200 bar)
Piston Head Torque (Apply Loctite 242 to Piston Head before tightening	737.8 lb ft (1000 Nm)
Max Speed	0.5 m/sec.
Max Operating Temperature	-22°F to 212°F (-30°C to 100°C)



1. Barrel
2. Piston
3. Setscrew
4. Piston Seal
5. Spacer
6. Head
7. O-Ring
8. Wiper
9. O-Ring
10. Wiper
11. Head Seal
12. Rod
13. Bushing

Figure 4-30. Extension Cylinder Assembly

Table 4-4. Deck Extension Cylinder Specs

Max Working Pressure	3045.7 psi (210 bar)
Full Bore Relief Pressure	1160.3 psi (80 bar)
Piston Torque (Apply Loctite 242 to Piston Thread before tightening)	147.5 lb ft (200 Nm)
Setscrew Torque	14.8 lb ft (20 Nm)
Max Speed	0.5 m/sec
Max Operating Temperature	22°F to 176°F (-30°C to 80°C)

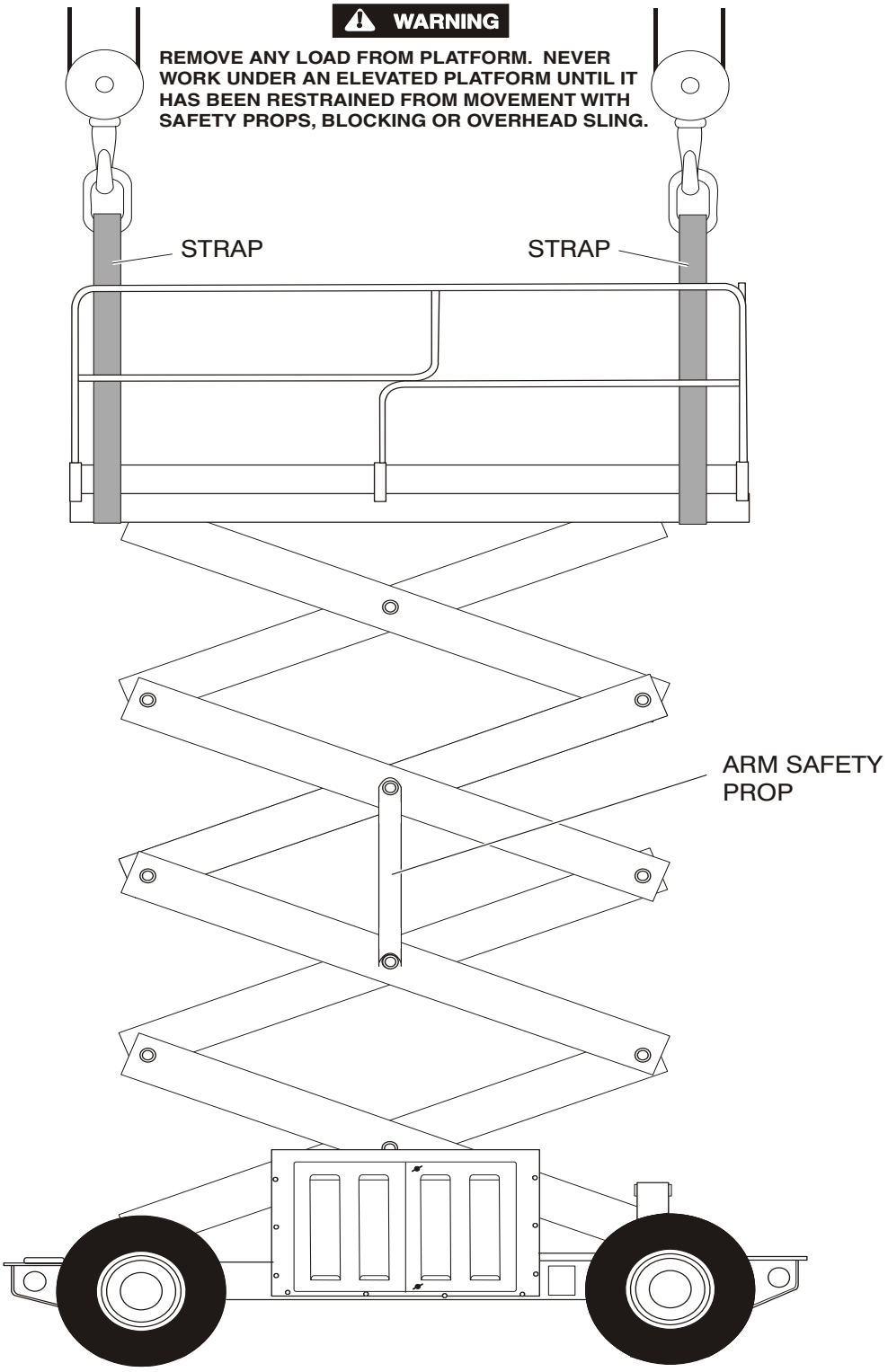
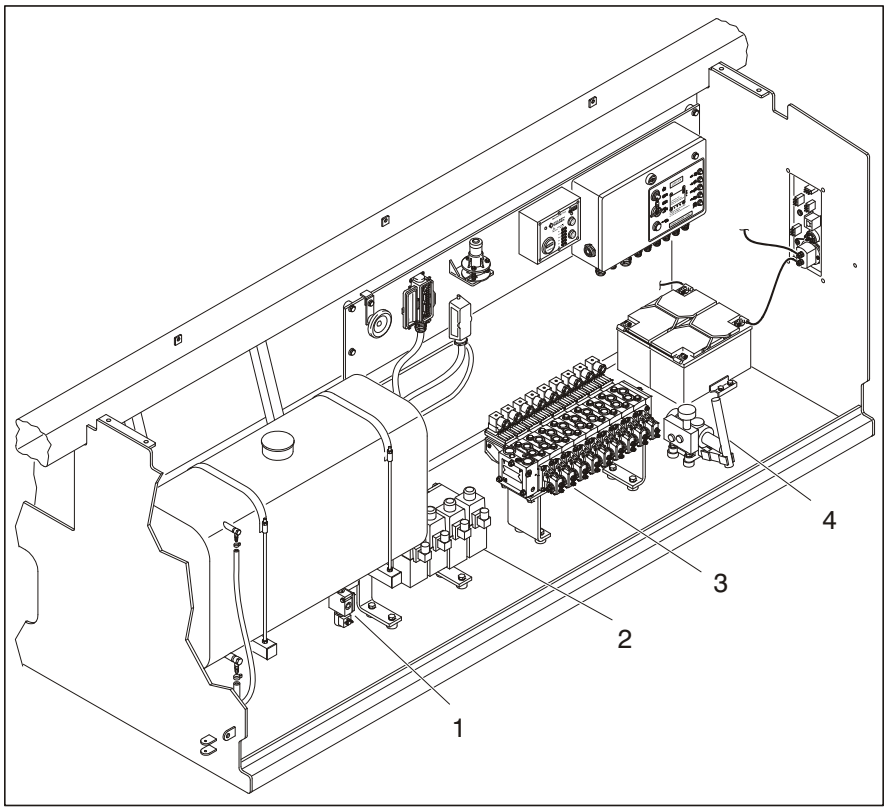

WARNING
REMOVE ANY LOAD FROM PLATFORM. NEVER WORK UNDER AN ELEVATED PLATFORM UNTIL IT HAS BEEN RESTRAINED FROM MOVEMENT WITH SAFETY PROPS, BLOCKING OR OVERHEAD SLING.
STRAP
STRAP
ARM SAFETY PROP

Figure 4-31. Arms and Platform Positioning and Support

4.5 VALVES

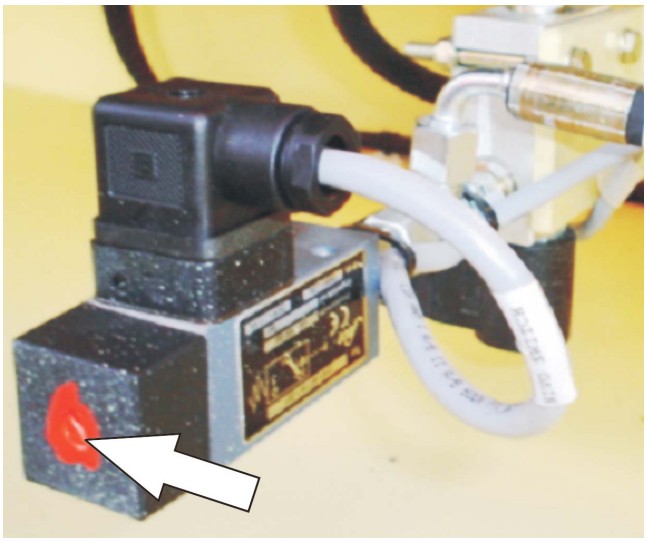
Valve Compartment



1. Pressure Switch, Drive Enable & Brake Valve
2. Drive Valve
3. Main Valve Block
4. Hand Pump

Figure 4-32. Valve/Hydraulic Compartment

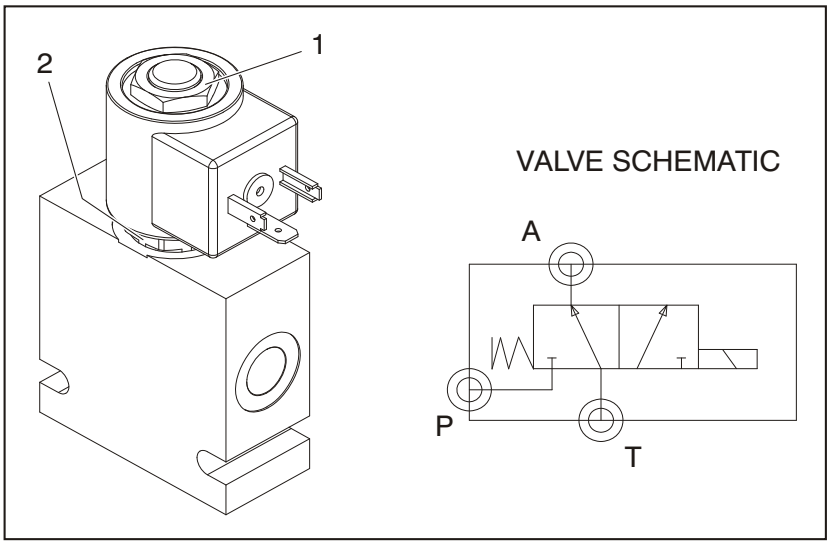
Pressure Switch, Drive Enable



- Operate the lower function to retract the jacks and adjust the switch (screw on the top of the switch) to trip at 2683 psi (185 bar)

Figure 4-33. Pressure Switch Adjustment

Brake Valve

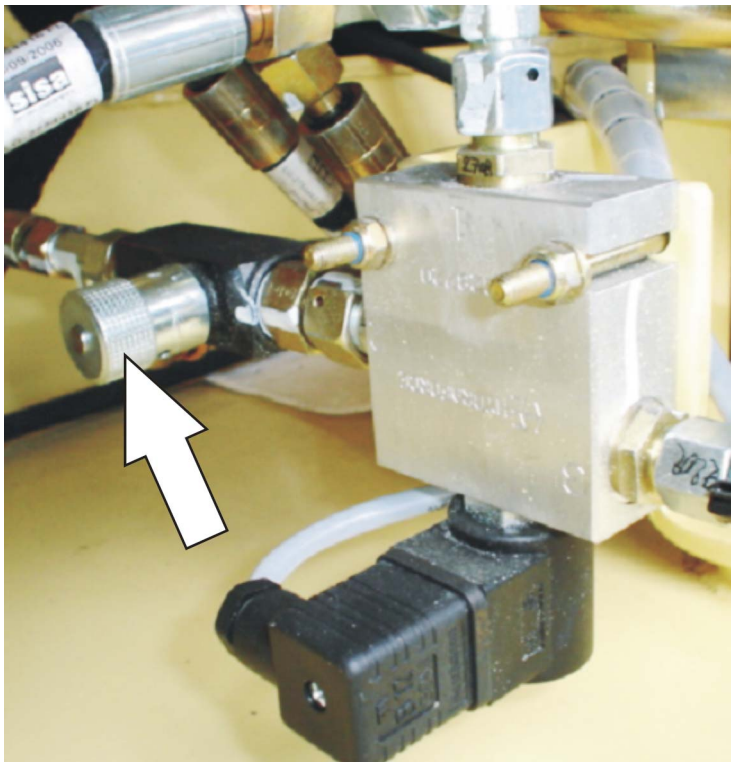


1. Torque to 5 ft lbs (6.8 Nm)
2. Torque to 20 ft lbs (27.1 Nm)

- Operating Pressure: 3000 psi (207 bar)
- Voltage: 24VDC

Figure 4-34. Brake Valve

Brake Valve Adjustment:



- To achieve smooth deceleration when the joystick is returned quickly from the max forward or backward position to the neutral position, completely close the valve knob (shown to the left) then open the knob 1/2 of a revolution.

Figure 4-35. Brake Valve Adjustment

Drive Valve

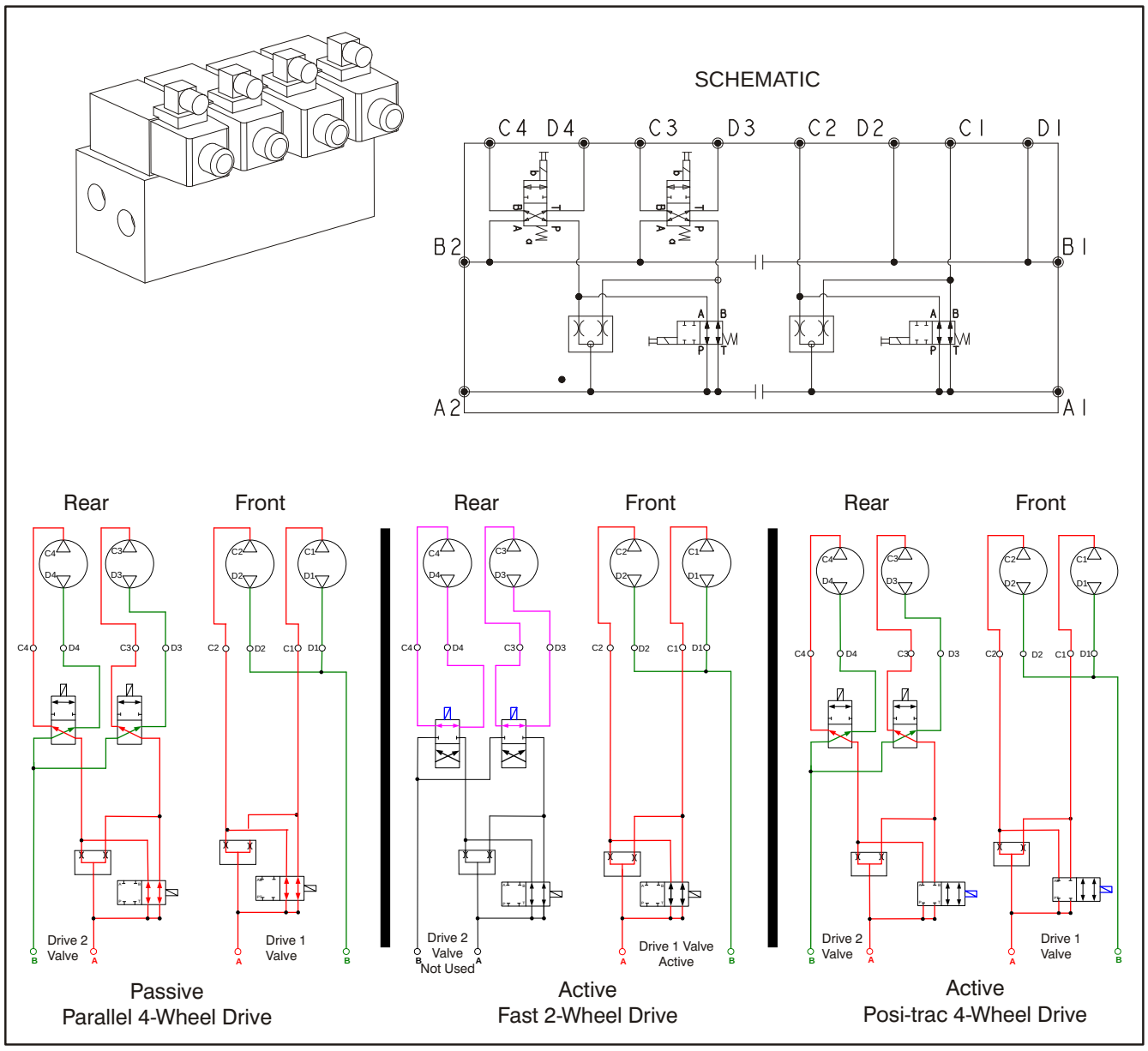
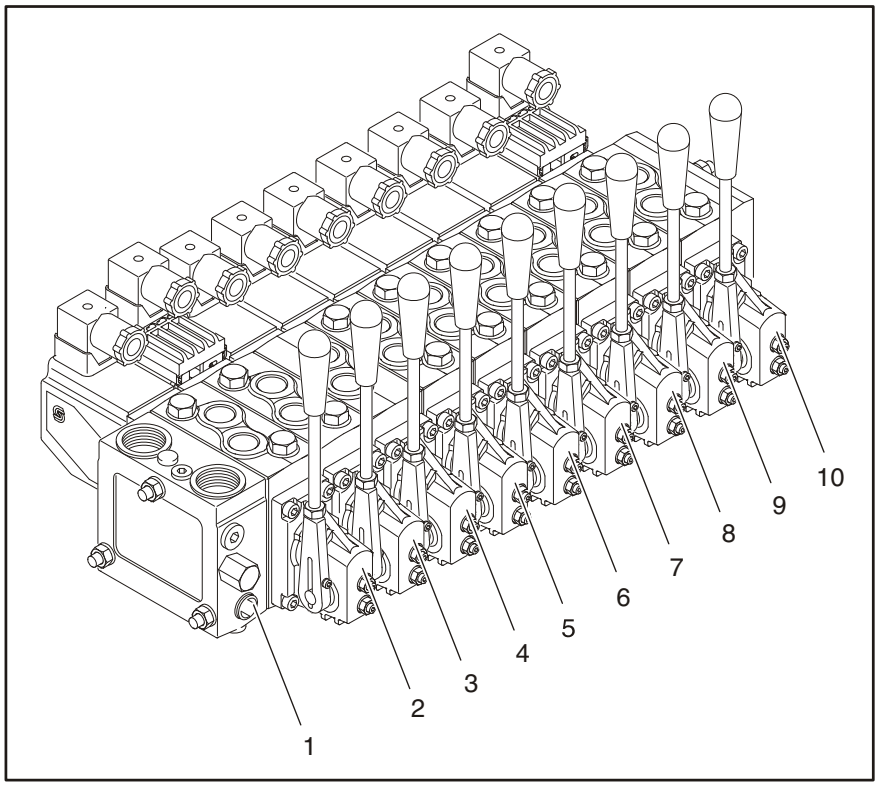


Figure 4-36. Drive Valve

- With no power activating the Valve Coils (1 thru 4), the machine is in 4 wheel drive low speed. A2 and A1 receive flow from both drive sections of the Main Valve Block.
- With 24V on Coils 1 and 2, all oil from the pump will give maximum oil flow through A1 section of the valve to the front wheels resulting in High Speed 2 Wheel Drive.
- With 24V on Coils 3 and 4, oil is forced through the flow dividers as it enters the A1 and A2 ports of the manifold, splitting 50% of the oil to each axle resulting in Differential Lock Tractor Drive.

Main Valve Block



1. Main Pressure Block
2. Platform
3. Drive 2
4. Lift
5. Steer
6. Rear Right Jack
7. Rear Left Jack
8. Front Right Jack
9. Front Left Jack
10. Drive 1

VALVE SCHEMATIC

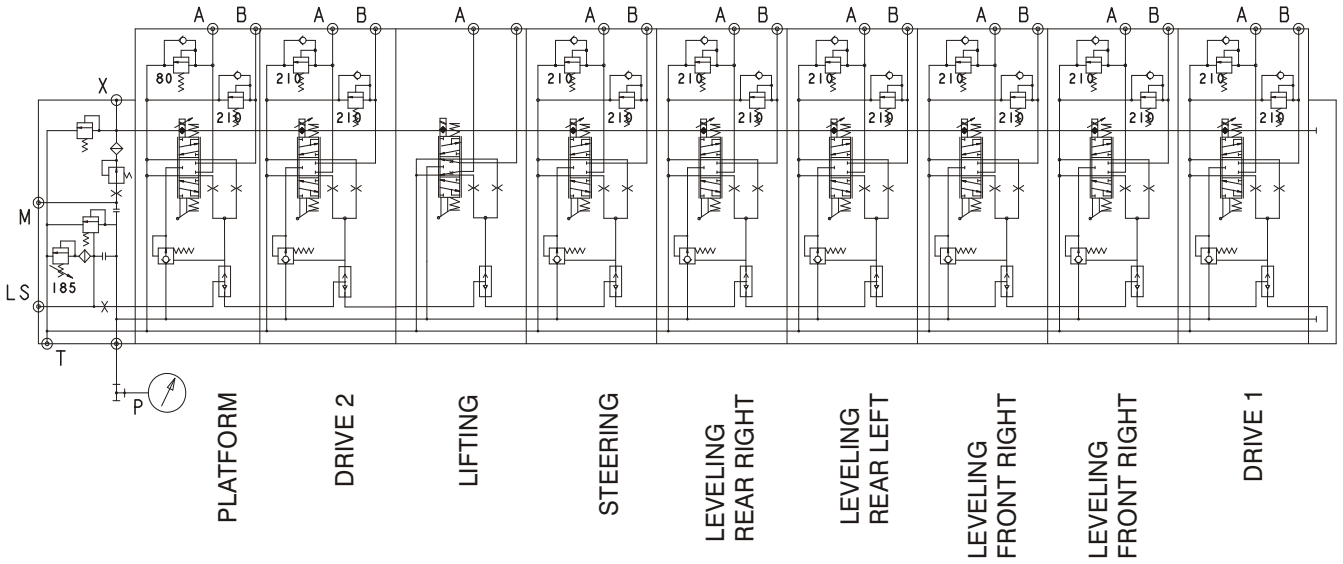


Figure 4-37. Main Valve Block

Adjust main pressure on top of the Main Pressure Block

- remove the cap and attach a pressure gauge to pressure test port (see Figure 4-38.)
- remove rubber plug from adjustment port
- pressure should be set to maximum of 210 bar (3045.8 psi). Adjust the setting screw fully in clockwise direction.(see Figure 4-39.)

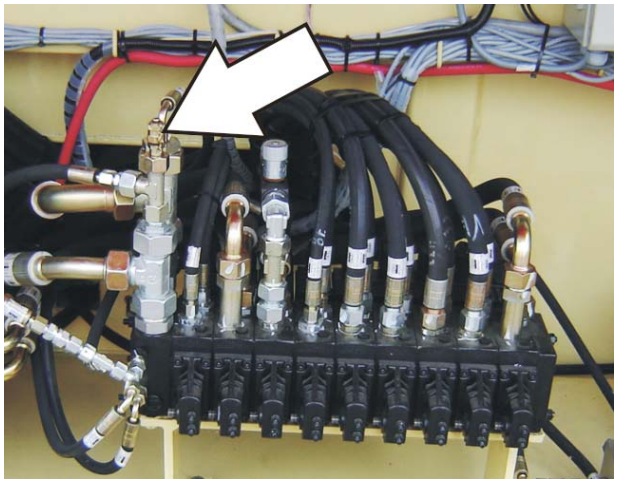


Figure 4-38. Pressure Test Port

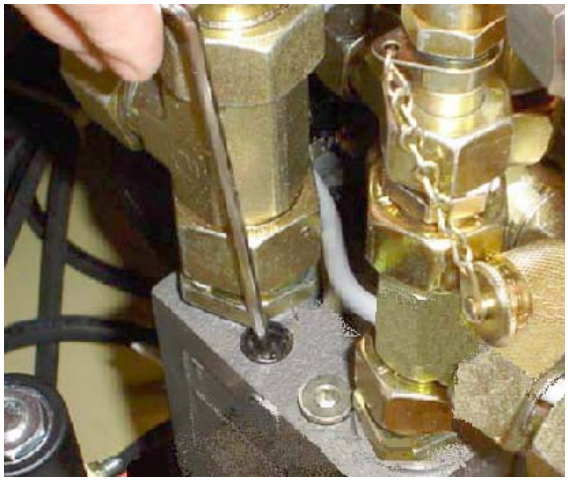
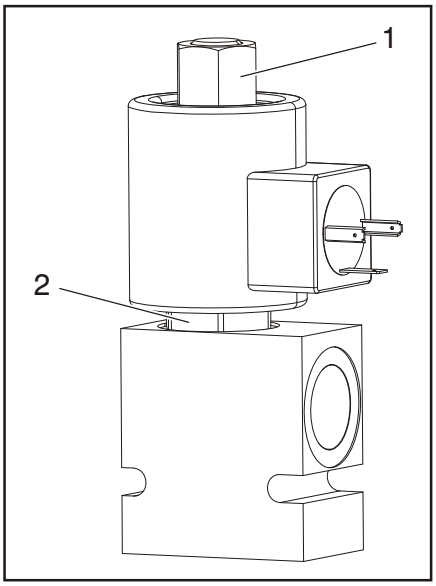


Figure 4-39. Proportional Valve Pressure Adjustment

Pump Engage/Disengage Valve

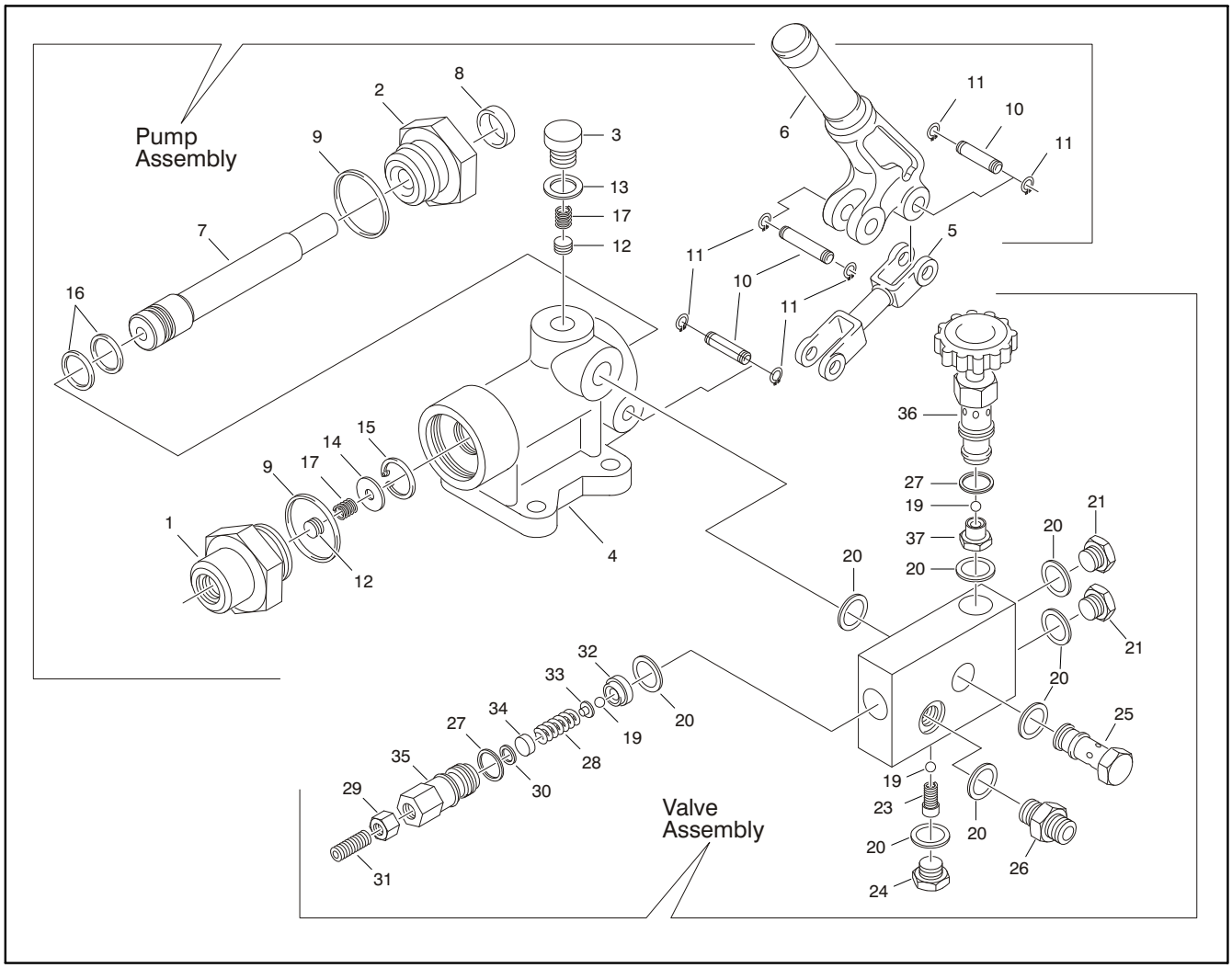


1. Torque to 5 ft lbs (6.8 Nm)
2. Torque to 25 ft lbs (33.9 Nm)

- Operating Pressure: 3000 psi (207 bar)
- Voltage: 24VDC

Figure 4-40. Pump Engage/Disengage Valve

Hand Pump



Pump Assembly

1. Valve, Suction
2. Plug
3. Plug
4. Body
5. Rod, connecting
6. Lever
7. Piston
8. Seal
9. Seal
10. Pin
11. Ring, Retaining
12. Ball
13. Ring
14. Washer
15. RIng, Internal Retaining
16. Seal
17. Spring

Valve Assembly

18. Body
19. Ball
20. Ring
21. Bolt M8 x 8mm
22. Spinner (Not Shown)
23. Spring
24. Plug
25. Screw
26. Fitting, Straight
27. Seal
28. Spring
29. Nut M10
30. Seal
31. Setscrew
32. Relief, Valve
33. Pin, Ball Driving
34. Plate, Seal
35. Valve Body
36. Knob Assembly
37. Valve Body

Figure 4-41. Hand Pump Assembly (prior to S/N 1200021263)

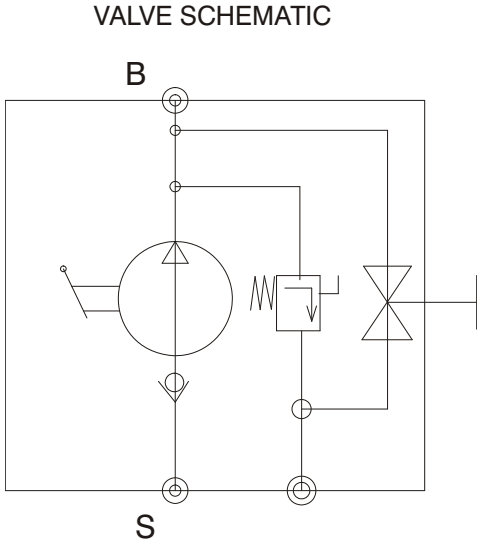
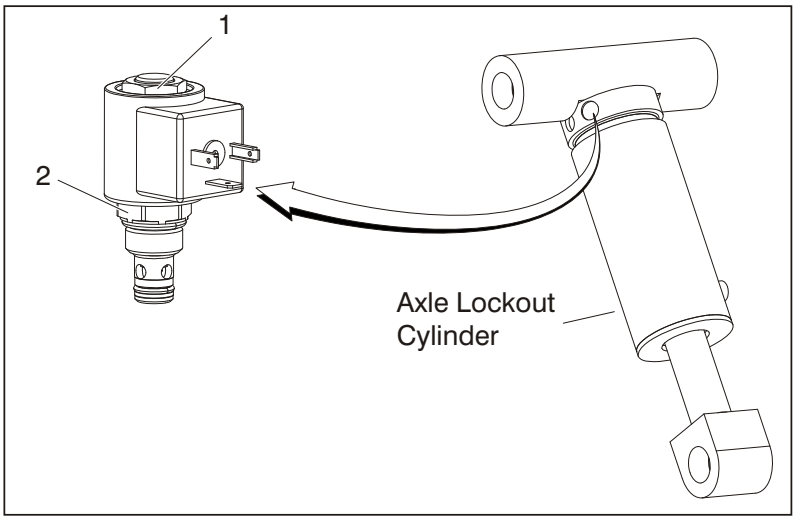


Figure 4-42. Hand Pump Valve Schematic

Load Holding Valve

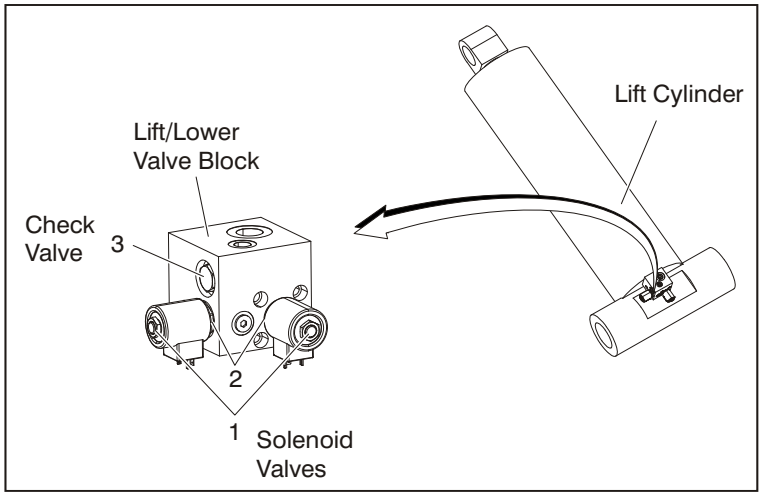


1. Torque to 5 ft lbs (6.8 Nm)
2. Torque to 20 ft lbs (27.1 Nm)

- Operating Pressure: 3000 psi (207 bar)
- Voltage: 24VDC

Figure 4-43. Load Holding Valve

Lift/Lower Valve Block



Solenoid Valves (Qty. 2)

1. Torque to 5 ft lbs (6.8 Nm)
2. Torque to 60 ft lbs (44.25 Nm)

- Operating Pressure: 3500 psi (240 bar)

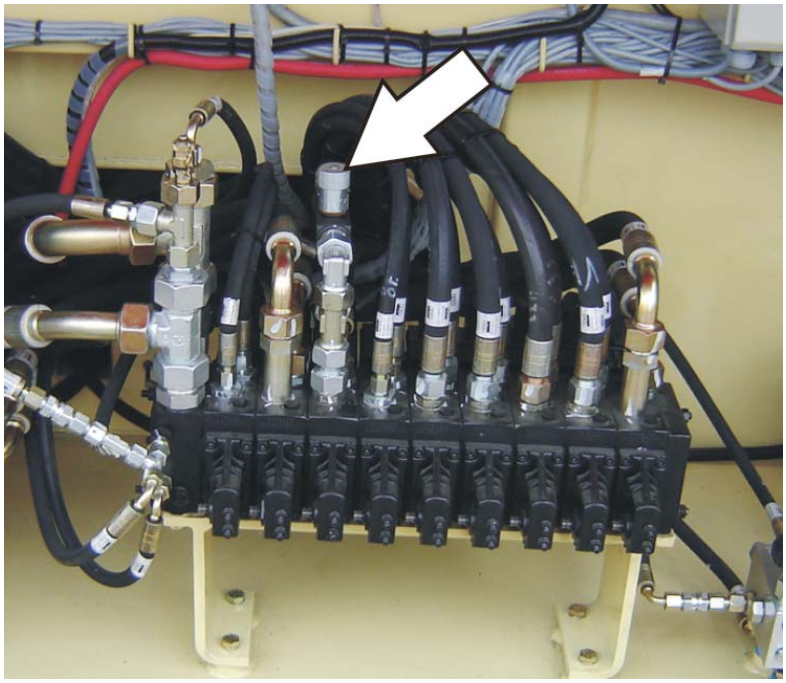
Check Valve

3. Torque to 20 ft lbs (27.1 Nm)

- Operating Pressure: 3500 psi (240 bar)

Figure 4-44. Lift/Lower Valve Block

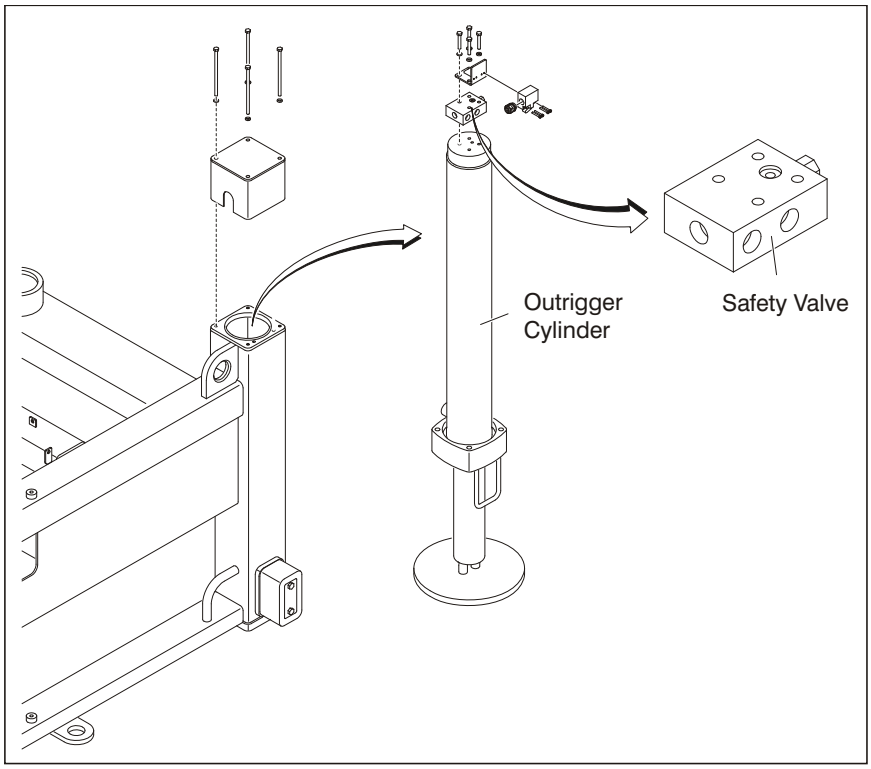
Platform Lower Flow Valve



- with the rated load on the platform (see Table 1-1), adjust the knob shown to the left to obtain the lowering speed as specified in (Table 1-1)

Figure 4-45. Platform Lower Flow Valve

Outrigger Safety Valves



Front Outriggers:

- Operating Pressure: 116 psi (8 bar)

Rear Outriggers:

- Operating Pressure: 14.5 psi (1 bar)

Figure 4-46. Outrigger Valves

NOTES:

SECTION 5. JLG CONTROL SYSTEM

5.1 MAIN TERMINAL BOX CIRCUIT BOARDS

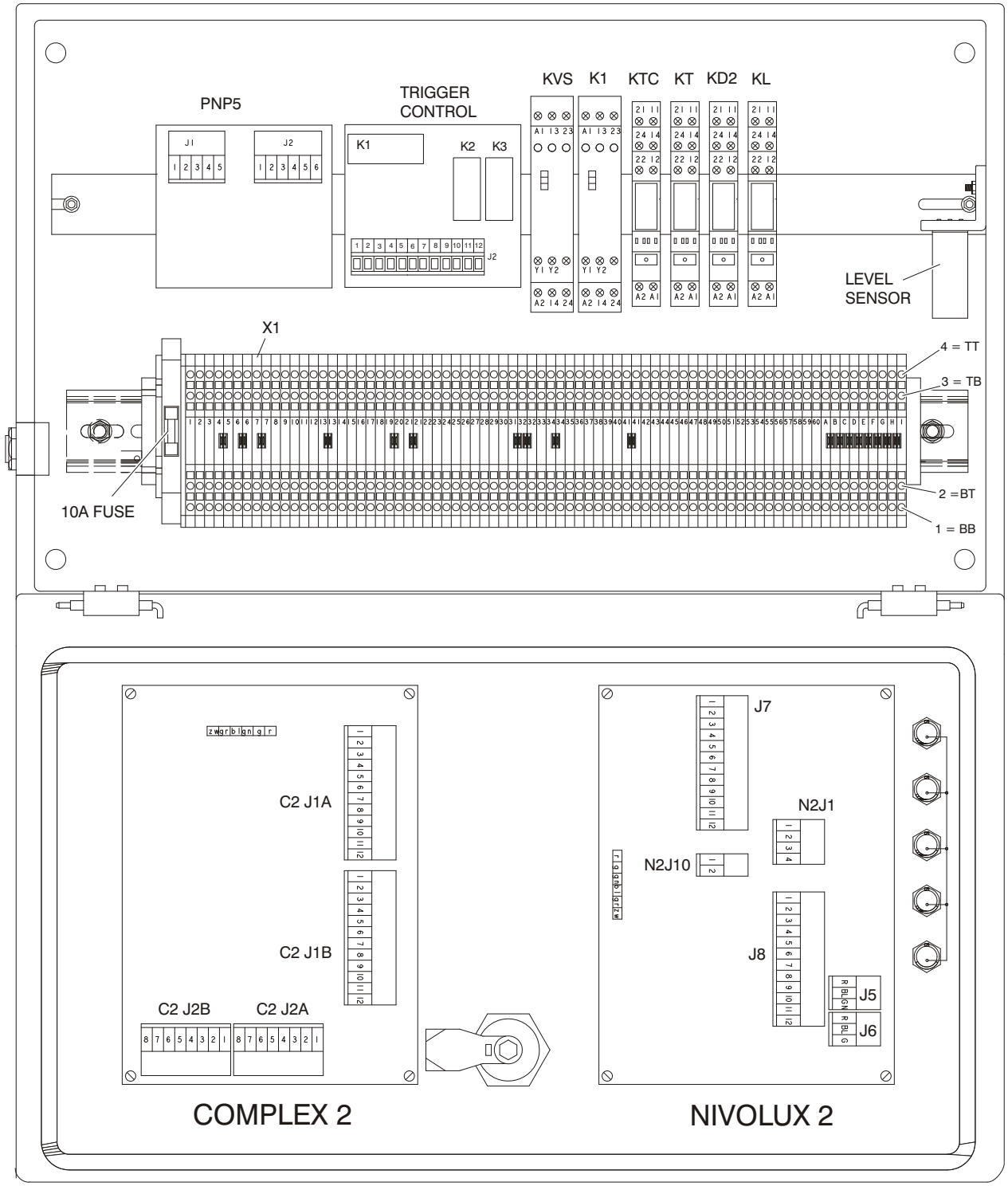


Figure 5-1. Main Terminal Box

5.2 CONTROL CARD COMPLEX 2

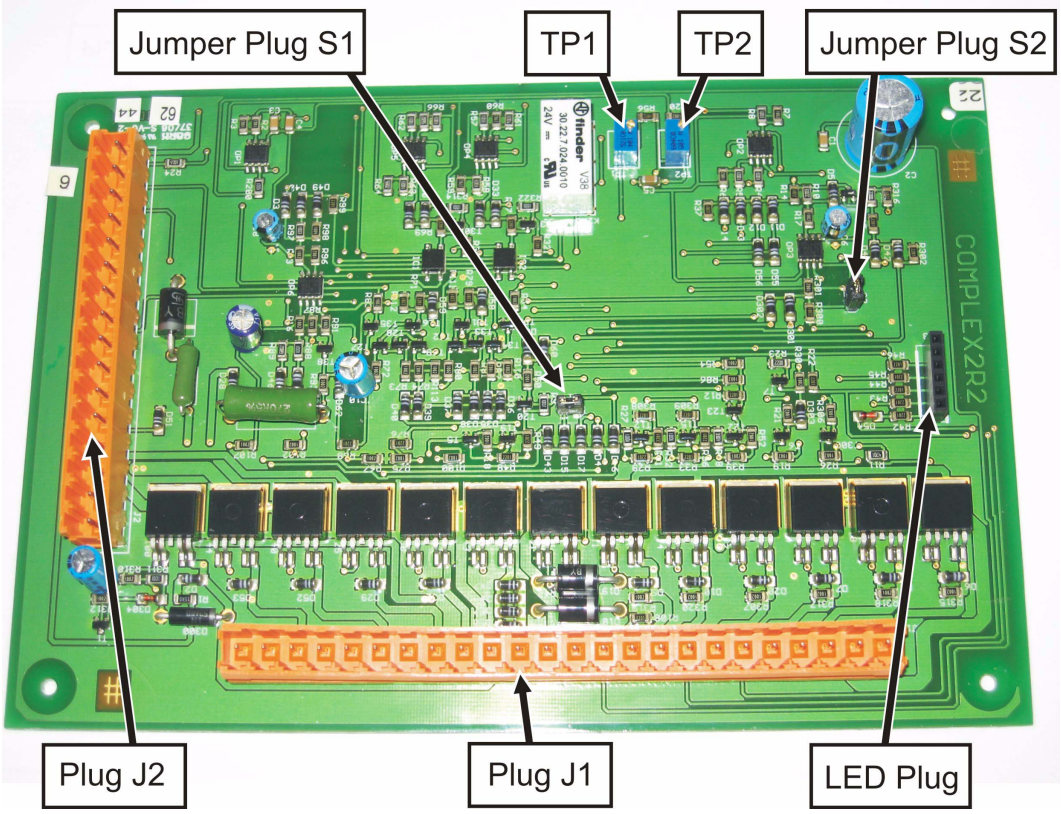


Figure 5-2. Control Card Complex 2 Board

General Description of Components and Functions

The Complex 2 Control circuit board is an electronic printed circuit board which processes the input signals from the control console (and the joystick trigger switch circuit board) and enables outputs to the rest of the machine control system.

The circuit board is located on the lid of the Main Terminal Box.

TP1 & TP2:

There are 2 potentiometers installed on the circuit card indentified as TP1 and TP2 which adjust the creep speed and the drive on/off ramp.

- TP1 - This is used to adjust the elevated creep speed by modifying the analogue output voltage to the drive control valve section. With the platform in an elevated position (fast drive speed limit switch tripped) and operating the machine with the console in the platform position, adjust the TP1 potentiometer to obtain the correct creep drive speed of 0.5 km/h.
- TP2 - This is used to adjust the ramp time to engage and disengage the drive control valve section. With the platform in the lowered position and operating the machine with the console in the platform position, adjust the TP2 potentiometer to obtain a drive acceleration and deceleration to ensure smooth operation. (nominal setting should be 2 seconds)

S1:

The connection S1 has not effect on the machine. (It's purpose, when removed, is to apply the ramp settings from TP2 to the pump output signal.)

S2:

The connection S2 must be closed with a jumper plug to enable the Lift and Lower output signals.

Table 5-1. J1 Connector

J1 Connector	
1	Drive
2	Drive Height LS
3	Lower
4	Ground
5	Lift
6	Joystick Analog Signal
7	Pump 1
8	Max Height L/S
9	Steer Right
10	Steer Left
11	Tilt Switch
12	Fast Drive
13	Fast Drive L/S
14	Not Used
15	Ignition
16	Pump 2
17	Start
18	Diff Lock
19	Platform In
20	Not Used
21	Ground
22	Platform Out
23	Horn
24	24V Power

Table 5-1 Key	
	= Output Signal
	= Input Signal
	= Not Used

Table 5-2. J2 Connector

J2 Connector	
1	24V to Console
2	Deck Extension
3	Ignition
4	Start
5	Horn
6	Not Used
7	Not Used
8	Differential Lock
9	Trigger Switch
10	Ground
11	Not Used
12	Steer Right
13	Lift Select
14	Steer Left
15	Fast Drive
16	Joystick Analog Signal

Table 5-2 Key	
	= Output Signal
	= Input Signal
	= Not Used

Table 5-3. J3 Connector

J3 Connector	
1	Not Used
2	Fast Drive LED
3	Max Height LED
4	Drive Height LED
5	Not Used
6	Ground

Table 5-3 Key	
	= Output Signal
	= Input Signal
	= Not Used

Table 5-4. Complex 2 Circuit Board

OUTPUT SIGNAL		INPUT SIGNAL	Platform Select	Lift Select	Signal + VS	Start (Switch)	Horn (Switch)	S2 Jumper Closed	Signal Diff Lock	Joystick Trigger Switch	Steering Left (on Joystick)	Steering Right (on Joystick)	Signal Fast Drive	Joystick Analog Signal	Joystick - GND	S Drive Available (S 8/18/21M)	S Max Platform Height	S Tilt Switch (not tilted)	S 2.5M (Fast Drive Available)
			J2/2	J2/13	J2/3	J2/4	J2/5		J2/8	J2/9	J2/14	J2/12	J2/15	J2/16	J2/10	J1/2	J1/8	J1/11	J1/13
Ignition (signal diesel and relais K)	J1/15				1														
Starter	J1/17				1	1													
Drive Signal (during Drive)	J1/1				1									1	1	1			
Drive Signal (during Steering)	J1/1				1						(1)	(1)				1			
Analog	J1/6				1									1	1				
Lift	J1/5		1	1				X						1	1		1		
Lower	J1/3		1	1				X						1	1				
Right Steer	J1/9			1								1				1			
Left Steer	J1/10			1							1					1			
SER/PAR	J1/12			1									1	1	1				1
Differential Lock	J1/18			1					1										
Platform In	J1/19	1		1										1	1				
Platform Out	J1/22	1		1										1	1				
Pump 1 & RPM (Lift or Lower Platform)	J1/7		1	1				X		1				1	1		1	(1)	(1)
Pump 1 & RPM (Drive)	J1/7			1						1				1	1			(1)	(1)
Pump 1 & RPM (Steer)	J1/7			1							(1)	(1)						(1)	(1)
Pump 1 & RPM (Ext/Retract Pltf)	J1/7	1		1						1				1	1			(1)	(1)
Pump 2, Drive Mode (if applicable)	J1/16			1						1			1	1	1	1		1	1
Pump 2, Lift Mode (if applicable)	J1/16		1	1				X		1			1	1	1		1	1	
LED S8/18/21M (Drive Available)	J3/4			1												1			
LED Max Height (Lift Available)	J3/3			1													1		
LED S2.5M (Fast Drive Available)	J3/2			1															1
Horn	J1/23			1		1													
Board Power																			
(Linked to J1/21 on Diesel units) Ground	J1/4			"Or" Signals (1)							S1 Jumper Closed								
Power (24V) Vs	J1/24																		

5.3 NIVOLUX - AUTOMATIC SELF-LEVELING SYSTEM

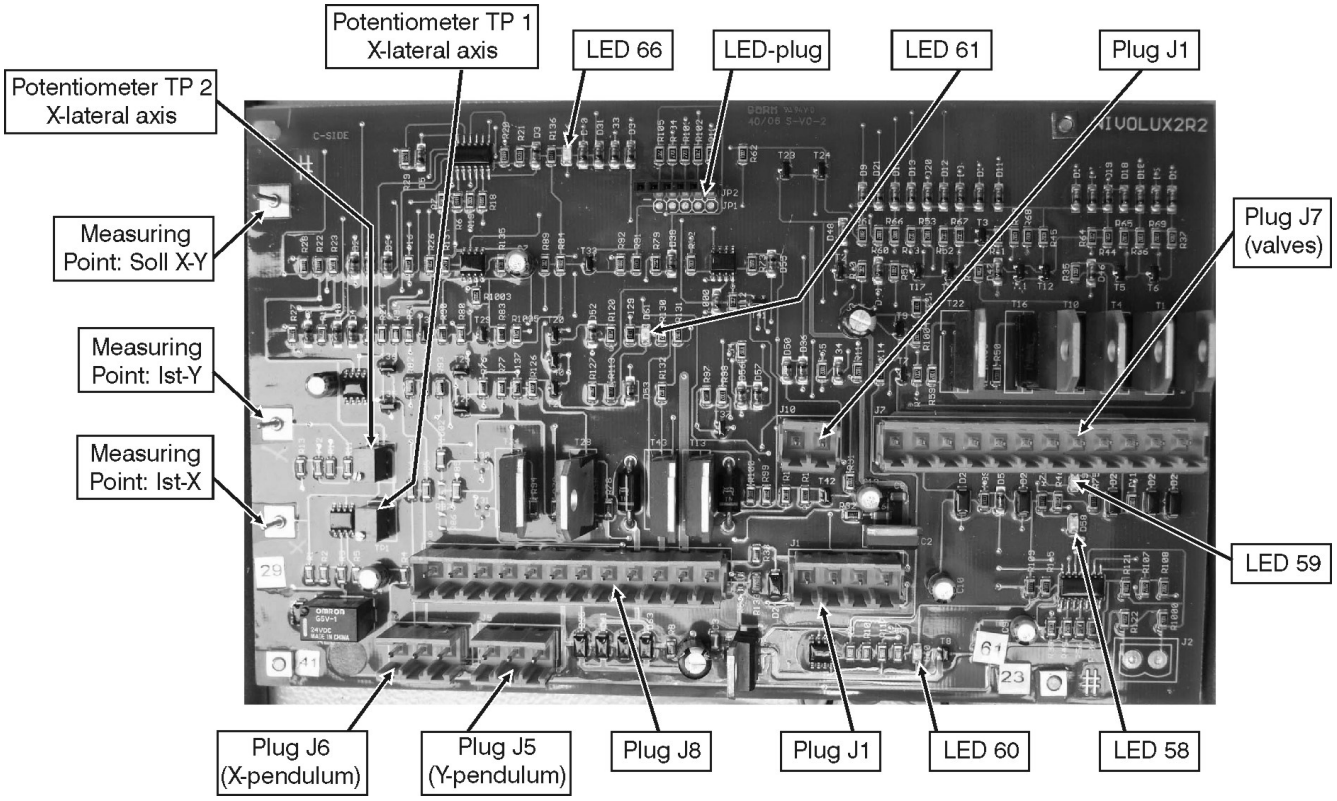


Figure 5-3. Nivolux Control Board

Introduction

Normally the operation of leveling the chassis on a Mobile Elevating Work Platform (MEWP) is very time consuming. The Liftlux NIVOLUX automatic self-leveling system eliminates this additional time, as it is a feature, when selected, of the normal lift and lowering operation. The estimated time saved over conventional systems can be in excess of 60%.

The System

A pair of angle sensors located inside the Main Terminal Box (MTB) senses the chassis angle of the MEWP. As indicated on the MTB decal, the inclination of the longitudinal axis is designated "Y" and the lateral axis is designated "X." The leveling function is achieved by hydraulic outrigger cylinders mounted at each corner of the chassis. Switches mounted on the top of each outrigger cylinder sense outrigger ground contact. The system is controlled by an electronic circuit board mounted in the MTB.

- The NIVOLUX automatic self-leveling system on JLG MEWPs is a selectable system.
- Deployment of the outriggers is necessary to achieve the maximum platform height.
- The system is intended for use when the machine is positioned on uneven ground.
- The system, when selected, operates automatically in conjunction with the control console when connected to either the platform, or chassis position. It does not operate in conjunction with the ground control station.

Operation

- The activation of the NIVOLUX self-leveling system is part of the lifting process. The system starts the leveling function when the lifting function is operated and the outrigger mode is selected. By activating the lifting function via the controller (joystick), the automatic measuring system is powered up, the drive function is blocked and the control LED's on the MTB indicate the chassis tilt attitude.
- The leveling process starts by powering the lowest outrigger until the difference of the measured angle to set point is less than 0.5°. The next lowest outrigger is then powered to level one axis within 0.5°.
- This process continues until both axes are within 0.5°. (i.e. the chassis is level)

- When the system completes the leveling process (sensed angle is within 0.5° of set point in both axis), the NIVOLUX system checks that all 4 outriggers have ground contact and then powers up the lift valve.

NOTE: *If ground contact is lost on any one of the 4 outriggers, the lift function will be cut. In this event, the platform should be fully lowered and the ground conditions checked before attempting to re-level the chassis.*

- All the above operation is performed with the engine at low idle speed. After the initial lift movement (a short time delay), the high engine speed solenoid is energized to deliver the required oil capacity for normal lifting operation.
- Above the Fast Speed Cutout Height (limit switch S 2.5m), the NIVOLUX Board cuts all output to the outrigger valves. This ensures that no leveling function can be performed with a raised platform.
- To retract the outriggers, it is necessary to maintain the lowering function via the controller (joystick) after the platform is in the fully lowered position. This position is sensed by the limit switch (Platform Down) and the NIVOLUX system automatically increases the engine speed from low idle and powers up the 4 outrigger retract valves.
- When all outriggers are retracted, the hydraulic system pressure increases to the relief setting. This pressure is sensed (at approximately 2683 psi (185 bar)) by a pressure switch and signals the NIVOLUX system to re-enable the drive function.
- This completes a full lifting cycle.

NIVOLUX Board LED's

LED	Meaning
Elevating the MEWP with outriggers selected:	
Red LED N° 59	Level OK
Red LED N° 60	Leveling Finished
Red LED N° 58	Ground Bearing Pressure Reached
Red LED N° 61	Ground Bearing Pressure OK and Start Lifting
After retracting the outriggers:	
Green LED N° 66	All Outriggers Retracted
Elevating the MEWP with outriggers OFF:	
Green LED N° 66	All Outriggers Retracted

Setting and Adjustment of the NIVOLUX Board

- Located on the circuit board is a potentiometer for each axis ("Y" longitudinal and "X" lateral) to set a zero point. There are three measuring points to accommodate a conventional voltmeter.

To Check and Set Adjustment:

1. Place the MEWP on an even, flat, and level surface. Ensure the MEWP is level to within ±0.5° of 0°.

NOTE: *The MEWP can be manually leveled by using the outrigger handles on the main valve block (refer to Figure 4-33., Main Valve Block). Lower outriggers by engaging the handles until the machine is level to within ±0.5° of 0° from front to back and right to left. Check with a digital level gauge.*

2. Ensure the Battery Disconnect is ON. Turn the select switch to Platform and switch outriggers select to Outriggers ON.
3. Power up the NIVOLUX board by switching the ignition switch on the console to ON.
4. Open the MTB and measure the voltage between the measuring points **SOLL X/Y** (supposed value) and **IST Y** (actual value) which are the upper and center measuring points. A voltage of +0.1V (100mV) represents about 1° of inclination (nose up). A value of -0.1V represents about 1° of inclination (nose down).
5. Adjust **TP2** (see Figure 5-3.) with a small screwdriver until your voltmeter shows zero. Turning counterclockwise reduces the value.
6. Measure the voltage between the measuring points **SOLL X/Y** (supposed value) and **IST X** (actual value) and follow the same steps as in step 5. **+0.1V** represents an inclination of approximately **1°** to the right and **-0.1V** represents an inclination of approximately **1°** to the left.
7. Turn off the ignition switch and close the MTB.

Table 5-5. NIVOLUX Circuit Board

Output Signal	Input Signal	J8/2 S2.5M (Fast Drive Available)	J8/3 RPM (Complex Out)	J8/6 Lift (From Complex Out)	J8/8 Lower (From Plat Down LS)	J8/9 +VS (kVS)	J5/3 X- Leveling (<7.5V)	J5/3 X+ Leveling (>7.5V)	J6/3 Y- Leveling (<7.5V)	J6/3 Y+ Leveling (>7.5V)	J10/2 24V (From Jacks Select Sw - Off)	J1/2 24V (from P Switch or K1)
RPM (to Deutz box & PNP) Lift wth NIVOLUX	J8/4		1	1								
RPM (to Deutz box & PNP) Lift wthout NIVOLUX	J8/4		1	1		1					1	
RPM (to Deutz box & PNP) Lowering	J8/4	1			1							
Lift Valve	J8/7			1		1						1
Drive OK with NIVOLUX	J8/10			0	(1)*	1					0	1
Drive OK without NIVOUX	J8/10					1					1	1
Front Left IN	J7/1	1			1						0	
Front Left OUT during leveling	J7/2	1		1			1		1		0	
Front Left OUT establishing ground pressure	J7/2	1		1			&	&	&	&	0	0
Front Right IN	J7/4	1			1						0	
Front Right OUT during leveling	J7/5	1		1				1	1		0	
Front Right OUT establishing ground pressure	J7/5	1		1			&	&	&	&	0	0
Rear Right IN	J7/7	1			1						0	
Rear Right OUT during leveling	J7/8	1		1				1		1	0	
Rear Right OUT establishing ground pressure	J7/8	1		1			&	&	&	&	0	0
Rear Left IN	J7/10	1			1						0	
Rear Left OUT during leveling	J7/11	1		1			1			1	0	
Rear Left OUT establishing ground pressure	J7/11	1		1			&	&	&	&	0	0
X Supply (15V)	J5/1	15V Output with Board Power On										
Y Supply (15V)	J6/1	15V Output with Board Power On										
24V (to P Switch and K1 23/24 contacts)	J1/1	24V Output with Board Power On										
24V (to Jack Select Switch) with NIVOLUX	J10/1			(1#)		1					0	
24V (to Jack Select Switch) without NIVOLUX	J10/1					1					1	
LED Left High	D42			(1)-)				1			0	
LED Right High	D43			(1)-)			1				0	
LED Front High	D44			(1)-)						1	0	
LED Rear High	D45			(1)-)					1		0	
LED No Drive (on)	D54			(1)-)							0	

Board Power	
Ground	J8/11
Vs (24V)	J8/1

* = This input is only necessary to establish output on J1/2. after the output J1/2 is established input J8/8 is not a necessity.

= J1/10 output is cut with a momentary lift input and reset with a J1/2 input, or recycling power.

& = 7.5V signal which is level input from sensors.

(1)-) = This input is only necessary to establish this output, after the output is established the input is not necessary.

5.4 PNP5 CIRCUIT BOARD

System

The PNP5 circuit board is an electronic printed circuit board mounted on the Din rail situated in the MTB (refer to Figure 5-1., Main Terminal Box).

Operation

The circuit acts on the control system in the following ways:

1. Amplifies signals to activate the drive and series/parallel hydraulic valves.
2. Activates the oscillating axle hydraulic valves when the platform is not elevated and the drive function is operated.
3. Enables the output to activate 2nd pump (if fitted and selected) when the platform is not elevated. Also delays this output until the engine speed and torque are sufficient. This delay is adjustable by means of a potentiometer on the board.

Adjustment

- With the platform stowed, position the drive speed select switch to 'High Speed.' Operate the drive function and adjust the potentiometer to produce a 2 second time delay pump 2 output (signal on J2/2) following the engine speed increase.

Table 5-6. PNP Circuit Board - I/O

IN		OUT Seris Parallel J1/3	Drive J1/5	Osc. Axle J2/3	Pump 2 J2/5
Drive	J1/1		1	1	
Series Parallel	J1/4	1			
Pump 2	J2/2				1*
S2.5m Limit Switch	J2/4			1	
High Engine (RPM)	J2/6				1*

Board Power	
24V (Vs)	J1/2
Ground	J2/1

*Adjust Potentiometer to delay Pump 2 output after RPM input. (allows engine to begin torque before adding load)

Table 5-7. Connector J1

Drive In	J1/1
Power 24V	J1/2
Series Parallel Out	J1/3
Series Parallel In	J1/4
Drive Out	J1/5

Table 5-8. Connector J2

Ground	J2/1
Pump 2 In	J2/2
Oscillating Axle	J2/3
S 2.5 In	J2/4
Pump 2 Out	J2/5
Engine RPM In	J2/6

5.5 TRIGGER CONTROL CIRCUIT CARD

Relay K1

NOTE: *Refer to Table 5-9 for numbers.*

1. Energized when there is a trigger input at 2.
2. When a start input signal is applied to 5, and there is no input from the trigger switch (no input on 2), the start ouput signal passes through the N.C. contacts on relays K1 and K2 to 6.
3. When a trigger input signal is present at 2, there is a 6 second window to receive a pump/lower input signal at 4 to keep K1 energized. This trigger input passes through the N.O. contacts to produce a trigger output on 3.
4. If there is no pump/lower input within this time (e.g. the trigger switch is taped closed), K1 is de-energized and the trigger output at 3 is cut.

Relay K2

1. Energized when there is a trigger input at 2.
2. This input passes through the N.O. contacts to produce a drive output on 8.
3. When this trigger input is removed, there is a 3 second time delay before K2 is de-energized and the drive output on 8 is cut. (Anti bounce function for the drive function).

Relay K3

1. Energized when there is a trigger output at 3.
2. The analogue input signal 4 passes through a set of N.O. contacts to produce an analogue output on 11.
3. The pump input signal 10 or lower input signal 9 passes through a set of N.O. contacts. This ouptu signal maintains the Trigger input signal 2 which energizes relay K1.

Table 5-9. Connector CON1

1	24V Supply
2	Trigger Switch Input
3	Trigger Switch Output
4	Analog Signal Input
5	Start Input
6	Start Output
7	Drive Input
8	Drive Output
9	Lower Signal Input
10	Pump Signal Output
11	Analogue Signal Output
12	Ground

Table 5-10. Trigger Control Circuit Board

	INPUT	Trigger Switch J2/2	Pupm or Lower J2/4	Start J2/5	Drive J2/7	Spare J2/9	Spare J2/11
OUTPUT							
Trigger Switch	J2/3	1				(1)	(1)
Start	J2/6	0		1			
Drive	J2/8	1			1		
Spare	J1/10	1	1			(1)	(1)

Board Power	
24V (Vs)	J2/1
Ground	J2/12

(1) Trigger Input = Pump/Lower input within 6 seconds

5.6 LIMIT SWITCH & SENSOR OPERATION

NOTE: *Refer to Figure 1-1., Limit Switch Locations for locations of limit switches.*

Height Limit Switches

Platform Stowed/Jacks Retract Limit Switch (S Platform Down):

This limit switch is mounted on the chassis and is activated by a cam mounted on the pivot of the scissor pack.

- When the platform is fully lowered, this switch is closed and permits a platform lower signal (from the Complex Board) to enable the NIVOLUX board to retract the outriggers.
- When this switch is activated, the outriggers can not be retracted.

High Drive Speed Cutout Limit Switch (S 2.5m):

This limit switch is mounted on the chassis and is activated by a cam mounted on the pivot of the scissor pack . When the platform is within approximately 0.5m (1.6 ft) of the fully lowered position, this switch is closed and 2 x 24V outputs are available.

- The Control System (Complex Board) uses one of these signals to enable fast drive and bypass the tilt switch lift cutout feature. The Self-Leveling System (NIVOLUX Board) also uses this signal to enable the outrigger valve outputs.
- The second bypasses the oscillating axle sensing switches.
- When this switch is activated, the drive speed is limited to slow speed. The Self-Leveling system valve outputs are cut and the tilt switch circuit controls the lift function which is cut out.

Maximum Drive Height/Maximum Height without Outriggers Limit Switch (S Drive Height):

This limit switch is mounted on the chassis and is activated by a cam mounted on the pivot of the scissor pack. When the platform is below the maximum permitted drive height, this switch is closed and 24V output is available.

- The Control System (Complex Board) uses this signal to enable the drive function.
- When this switch is activated, the drive function is cut. When elevating without outriggers deployed, this switch will also prevent lifting above the drive cutout height.

Maximum Height Limit Switch (S Max Height):

This limit switch is mounted on the chassis and is activated by a cam mounted on the pivot of the scissor pack.

- When the platform is below the maximum height, this switch is closed. One contact passes a 24V signal to the Control System (Complex 2 Board) to enable lift up.
- The other contact passes 24V from Relay KT contacts to the Ground control Lift Up Switch.
- When this switch is activated, the lift function is cut.

Tilt Switch

S Tilt Switch:

The scissor lift is equiped with a chassis inclination sensor set to trip at 3°. The value of the incline will be monitored by a tilt switch, which will cut off lifting, driving, and steering once the platform is raised (above High Drive Speed Cutout Limit Switch (S 2.5m)) and the set angle is reached. The lowering function remains available to bring the platform below the High Drive Speed Cutout Limit Switch (S 2.5m) height. This permits the drive function to enable the MEWP to be repositioned on a level surface. This multi axis tilt switch is mounted in the valve compartment to sense the angle of the chassis. The Control System (Complex 2 Board) uses the input signal from the High Drive Speed Cutout Limit Switch (S 2.5m) to bypass this tilt switch.

- When the chassis is within the set point angle limits, there is a constant output of 24V. The Control System (Complex 2 Board) uses this signal to permit the lift up, drive, and steering functions when the machine is elevated (S 2.5m is cut).

When tilted beyond 3°, there is zero output and a red LED on the console is turned on by means of relay KT. Also, when S 2.5m Limit Switch is activated, the functions of lift, drive, and steer are also cut.

Adjustment:

Place the machine on a flat level surface. Using a digital level, ensure the chassis is level. Adjust the X and Y axis nuts to place the top mounted bubble level in the center.

Oscillating Axle Limit Switches

A pair of switches are mounted on the oscillating axle and sense the angle of the axle with respect to the frame. These are wired in series with the S8m Limit Switch. The S2.5m Limit Switch signal bypasses both switches.

- When the axle is within 1.5° of the frame, the switches are closed and permit a 24V signal to the S8m Switch.
- When either of the switches are activated and Limit Switch S2.5m is also activated, the drive function is cut.

Outrigger Limit Switches

These 4 limit switches are mounted on the top (barrel end) of each outrigger cylinder and work in conjunction with the NIVOLUX Automatic Self-Leveling System. They are utilized to sense when the outrigger pad makes ground contact and are wired in series on both the normally open (N.O.) and normally closed (N.C.) contacts.

- Refer to Section 5.3, Nivolux - Automatic Self-Leveling System for a description of the operation.

Pressure Switch

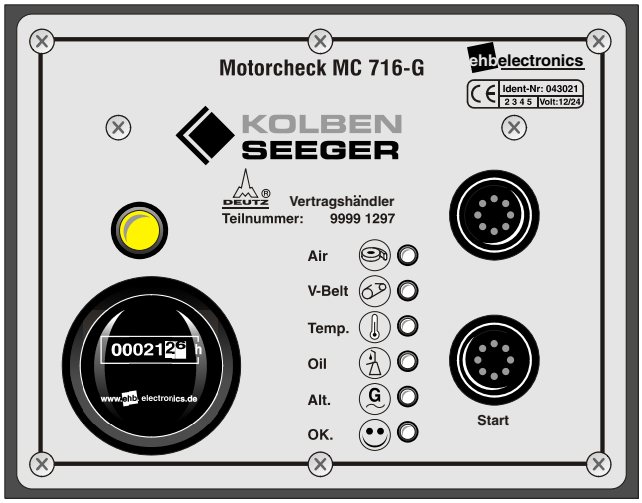
A pressure switch is line mounted in the drive brake hydraulic line. This pressure switch works in conjunction with the NIVOLUX Automatic Self-Leveling System.

- Refer to Section 5.3, Nivolux - Automatic Self-Leveling System for a description of the operation.

Table 5-11. Limit Switches

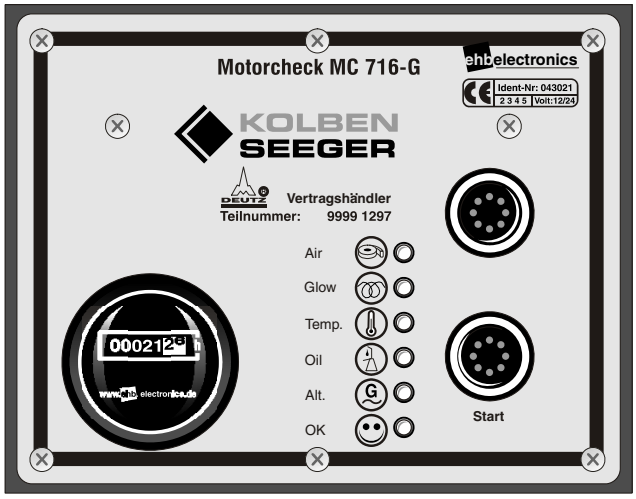
Switch	Purpose
Outriggers	**Jacks Selected** = No switch input to X1/43 and N.C. contacts wired in series to sense ground contact for all jacks then enable lift up by energizing relay K1.
	Jacks Not Selected = Switch input to X1/43 and N.O. contacts wired in series to sense all jacks retracted and enable lift up by energizing relay K1.
S Platform Down	**N.C. contacts** sense when platform is fully lowered. Enables jacks retract (select by resetting lift switch when fully lowered and continue to lower) and re-enable drive function. Only when jacks are selected.
S 2.5m	**N.C. contacts** sense at +/- 12 ft (3.7m) platform height and interlock fast drive speed. Interlock drive and lift if tilted (tilt switch tripped). Also indicates lift available LED at console.
S 8m	**N.C. contacts** sense max permitted drive height of the platform and interlocks drive function. Senses max lift height when outriggers are not deployed. Also indicates lift available LED at console.
S Max Height	**N.C. contacts** sense max platform height and interlocks lift up. Also indicates lift available LED at console.

5.7 ENGINE CONTROL SYSTEM



H005559

OR



1001094781

Functional Description

NOTE: *For desciptions in ( ), refer to Figure 6-23., Electrical Schematic - Sheet 6 of 15*

1. An ignition input on X1/1 (15) creates an output at X2/8 (fuel solenoid). (On H005559, this input also powers up the glow plug relays at X2/23). Initially all 6 LEDs will flash 3 times, to test the system and the LEDs. After this startup check, only the OK LED should flash. An additional 7 seconds later, the system monitoring system is activated and the circuit recognizes fault input signals.
2. A start input on X1/2 (50e) creates an output at X2/7 (start relay). This input is ignored by the system after 10 sec. to protect against short circuit, or switch "contact stuck closed" situations. The output is also dependant on the alternator input signal.
3. The alternator input X2/10 (W) is monitored in the following way:
   a. When a start signal is applied to X1/2 (50e), the input on X2/10 needs to be less than 4Hz to enable an output at X2/7 (50f). (Start lockout feature when engine is running).
   b. When X2/10 reaches 150Hz, the X2/7 output is cut (engine is sensed to be running and start signal is cut).

NOTE: *An input frequency of 80Hz can be achieved when the engine is cranking, but not started. If this occurs, increase the sensing trip point in the E-prom on the circuit board to 150Hz. This ensures the engine is running before cutting the start signal.*

   c. When a start signal is applied to X1/2 (50e) and the input on X2/10 remains zero, after 1 second of cranking, the output X2/7 is cut and the G LED turns on (no input from alternator).

NOTE: *The field current strength, during initial start in cold temperatures, from the W input (600mA) can be insufficient to generate a sensed signal. If this occurs, increase the field current sensed to 1A by reducing the exciter resistor to 23.5 Ohm from 39 Ohm. This ensures sufficient initial start signal strength in cold weather.*

   d. If X2/10 goes to zero when the engine is running, the output to X2/8 is cut and the G LED turns on (lost input from alternator).
4. There is a 6 second time delay between start attempts. The 6 seconds starts when there is zero input on X2/10.
5. The main use of the additional push button "Start Assist" is to prime the fuel line. When this button is operated simultaneously with the start button, the start cut out control feature is ignored. This condition continues for 3 minutes during which only one start attempt can be made.
6. When there is an imput to X2/11 the Glow Time LED (lamp on H005559) is turned on. The duration of the time on is controlled by the glow relays.
7. When there is an air intake filter clogged input (ground) on X2/4 (Air), the fault LED on the panel is illuminated. This is an indication warning only. It does not cut the engine. This warning signal

remains on, even if the switch resets, until the ignition input X1/1 (15) is recycled.

8. The monitoring system will shut the engine down (ouput to X1/7 is cut) if one of the following fault input signals is present for 3 seconds:
   a. No frequency on W - X2/10
   b. Input on Oil - X2/1
   c. Input on Temp - X2/3
9. When there is a 24V output on X2/9 (50f), the engine speed is increased by energizing the throttle solenoid. The circuit card generates this output from a 24V input on X1/3 (Aux2).

Table 5-12. Deutz Engine Control Board

IN		OUT: Start Solenoid X2/7	Fuel Solenoid X2/8	Throttle Solenoid (RPM) X2/9
Ignition	X1/1	1	1	1
Start	X1/2	1		
RPM	X1/3			1
Oil Pressure Switch (Ground)	X2/1		0	
Alternator (D+)	X2/2			
Temperature Switch (Ground)	X2/3		0	
Air Filter Switch (Ground)	X2/4		0	
Alternator (W)	X2/10	"0"		
Glow Time (Ground) or Vee Belt (Ground	X2/11			
Power 24V	X2/5	+	+	+
Ground	X2/6	-	-	-

"0" = Zero frequency

Table 5-13. Deutz Engine

Connector X1	
Ignition	X1/1
Start	X1/2
RPM	X1/3

Connector X2	
Oil Pressure Switch (Ground)	X2/1
Alternator (D+)	X2/2
Temperature Switch (Ground)	X2/3
Air Filter Switch Ground)	X2/4
Power 24V	X2/5
Ground	X2/6
Start	X2/7
Fuel Solenoid	X2/8
RPM Solenoid	X2/9
Alternator (W)	X2/10
Glow Plug (Ground) or Vee Belt (Ground)	X2/11

Through Line Connector
24V Power (direct to battery)
24V Power Alternator (B+)

Input	
	Output

SECTION 6. GENERAL ELECTRICAL INFORMATION & SCHEMATICS

6.1 GENERAL

This section contains schematics to be used for locating and correcting most of the operating problems which may develop. If a problem should develop which is not presented in this section or which is not corrected by listed corrective actions, technically qualified guidance should be obtained before proceeding with any maintenance.

6.2 MULTIMETER BASICS

A wide variety of multimeters or Volt Ohm Meters (VOM) can be used for troubleshooting your equipment. A digital meter with reasonable accuracy (within 7%) is recommended for the measurements in these procedures. This section shows diagrams of a common, digital VOM configured for several different circuit measurements. Instructions for your VOM may vary. Please consult the meter operator's manual for more information.

Grounding

"Grounding the meter" means to take the black lead (which is connected to the COM (common) or negative port) and touch it to a good path to the negative side of the voltage source.

Backprobing

To "backprobe" means to take the measurement by accessing a connector's contact on the same side as the wires, the back of the connector. Readings can be done while maintaining circuit continuity this way. If the connector is the sealed type, great care must be taken to avoid damaging the seal around the wire. It is best to use probes or probe tips specifically designed for this technique, especially on sealed connectors. Whenever possible insert probes into the side of the connector such that the test also checks both terminals of the connection. It is possible to inspect a connection within a closed connector by backprobing both sides of a connector terminal and measuring resistance. Do this after giving each wire a gentle pull to ensure the wires are still attached to the contact and contacts are seated in the connector.

Min/Max

Use of the "Min/Max" recording feature of some meters can help when taking measurements of intermittent conditions while alone. For example, you can read the voltage applied to a solenoid when it is only operational while a switch, far from the solenoid and meter, is held down.

Polarity

Finding a negative voltage or current reading when expecting a positive reading frequently means the leads are reversed. Check what reading is expected, the location of the signal and that the leads are connected to the device under test correctly. Also check that the lead on the "COM" port goes to the ground or negative side of the signal and the lead on the other port goes to the positive side of the signal.

Scale

M = Mega = 1,000,000 * (Displayed Number)

k = kilo = 1,000 * (Displayed Number)

m = milli = (Displayed Number) / 1,000

μ = micro = (Displayed Number) / 1,000,000

Example: 1.2 kΩ = 1200 Ω

Example: 50 mA = 0.05 A

Voltage Measurement

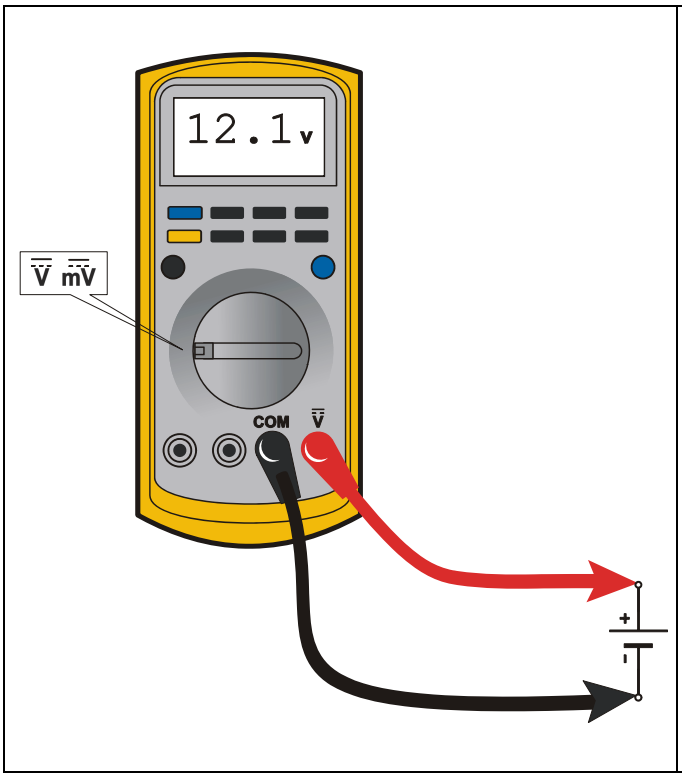


Figure 6-1. Voltage Measurement (DC)

- If meter is not auto ranging, set it to the correct range (See multimeter's operation manual)
- Use firm contact with meter leads

Resistance Measurement

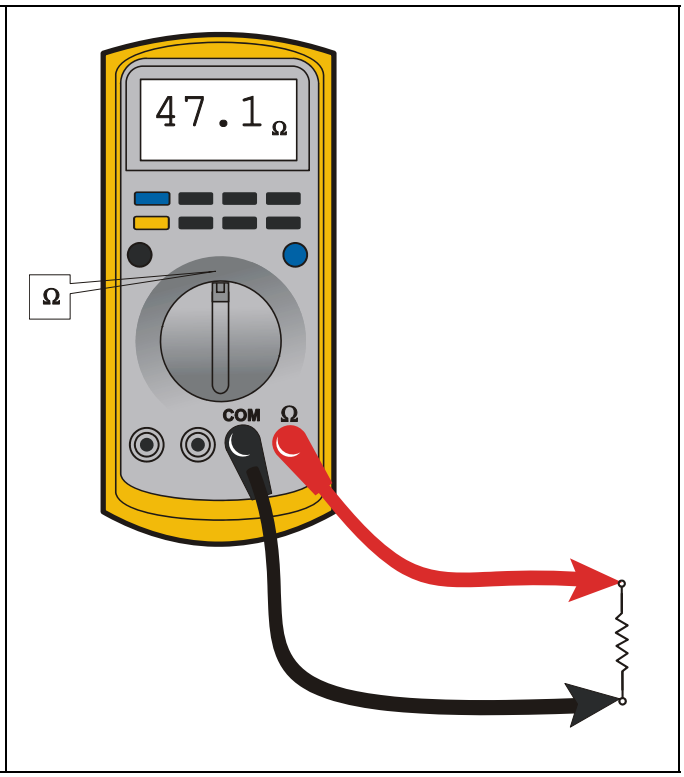


Figure 6-2. Resistance Measurement

- First test meter and leads by touching leads together. Resistance should read a short circuit (very low resistance)
- Circuit power must be turned OFF before testing resistance
- Disconnect component from circuit before testing
- If meter is not auto ranging, set it to the correct range (See multimeter's operation manual)
- Use firm contact with meter leads

Continuity Measurement

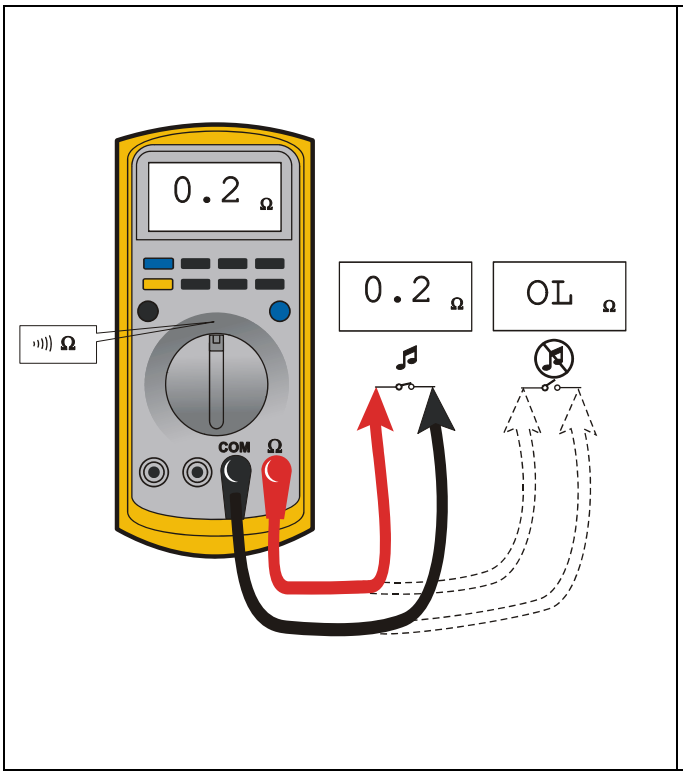


Figure 6-3. Continuity Measurement

- Some meters require a separate button press to enable audible continuity testing
- Circuit power must be turned OFF before testing continuity
- Disconnect component from circuit before testing
- Use firm contact with meter leads
- First test meter and leads by touching leads together. Meter should produce an audible alarm, indicating continuity

Current Measurement

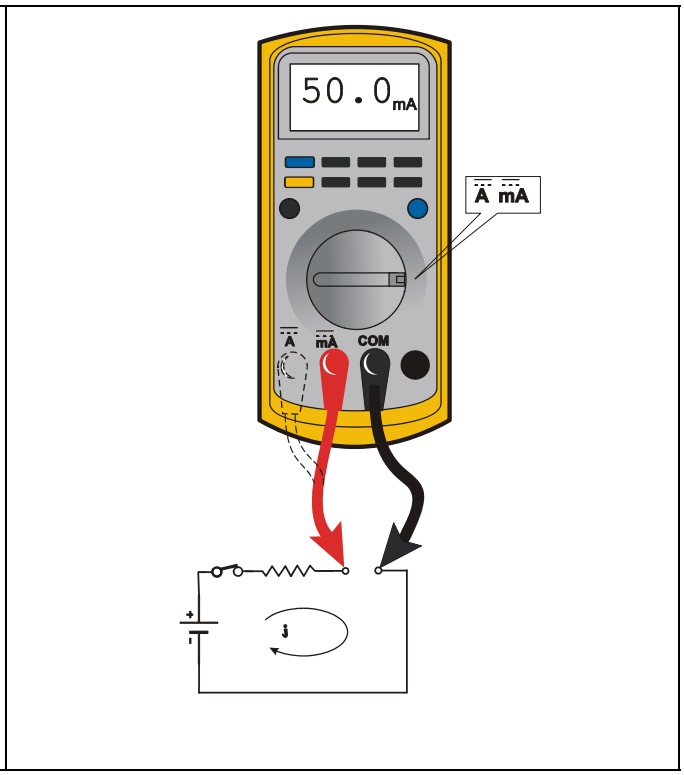


Figure 6-4. Current Measurement (DC)

- Set up the meter for the expected current range
- Be sure to connect the meter leads to the correct jacks for the current range you have selected
- If meter is not auto ranging, set it to the correct range (See multi meter's operation manual)
- Use firm contact with meter leads

Continuity Measurement Over Long Distances

When trying to determine continuity of a harness or wire, longer than the reach of standard instrument leads, is possible to perform the check without excessively long leads. Using the other wires in the harness one can determine the condition of a particular wire in the harness.

Requirements:

- Harness with at least three separate wires including the wire under test.
- These wires must be able to be isolated from other wires, etc.
- Jumper or method to connect contacts on one side of harness.
- Meter that can measure resistance or continuity.

Procedure

Test multimeter leads resistance. Subtract this value from the measured resistance of the wires to get a more accurate measurement.

Consult the circuit schematic to determine which wires to use in addition to wire under test, here called wire #1 and wire #2, and how to isolate these wires. These wires should appear in the same connectors as the wire under test or are within reach of the jumper.

1. Disconnect all connections associated with the wire under test and the two additional wires. If harness is not completely isolated disconnect battery terminals also, as a precaution.
2. Measure continuity between all three wires, the wire under test, wire #1 and wire #2. These should be open. If not, repair the shorted wires or replace the harness.
3. On one side, jumper from contact of wire #1 and wire #2.
4. Measure continuity between wire #1 and wire #2. If there is continuity, both wires are good and can be used for this test. If there is not continuity, either wire could be bad. Check connections and measurement setup. Redo measurement. If still no continuity, repair wires or consult schematic for other wires to use for test.
5. Jumper from wire under test to wire #1.
6. Measure continuity. If there is continuity, the wire under test is good. Resistance of a wire increases as the length increases and as the diameter decreases.

One can find the continuity of two wires, here #1 and #2, at once by following steps 1 through 4. If there is a problem the third wire is used to troubleshoot the other wires. To find the problem, start at step 1 and use the entire procedure.

6.3 APPLYING SILICONE DIELECTRIC COMPOUND TO AMP CONNECTORS

Silicone Dielectric Compound must be used on the AMP connections for the following reasons:

- To prevent oxidation at the mechanical joint between male and female pins.
- To prevent electrical malfunction caused by low level conductivity between pins when wet.

Use the following procedure to apply Silicone Dielectric Compound to the electrical connectors.

1. To prevent oxidation and low level conductivity, silicone dielectric grease must be packed completely around male and female pins on the inside of the connector after the mating of the housing to the header. This is easily achieved by using a syringe to fill the header with silicone dielectric compound, to a point just above the top of the male pins inside the header. When assembling the housing to the header, it is possible that the housing will become air locked, thus preventing the housing latch from engaging.
2. Pierce one of the unused wire seals to allow the trapped air inside the housing to escape.
3. Install a hole plug into this and/or any unused wire seal that has silicone dielectric compound escaping from it.

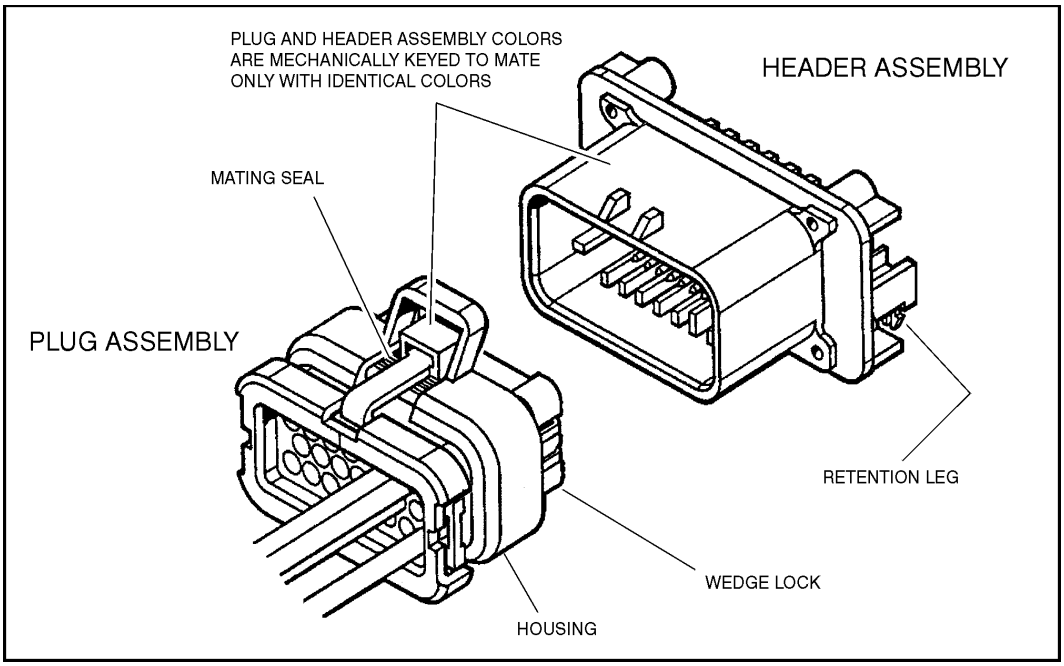


Figure 6-5. AMP Connector

Assembly

Check to be sure the wedge lock is in the open, or as-shipped, position (See Figure 6-6. Connector Assembly (1 of 4)). Proceed as follows:

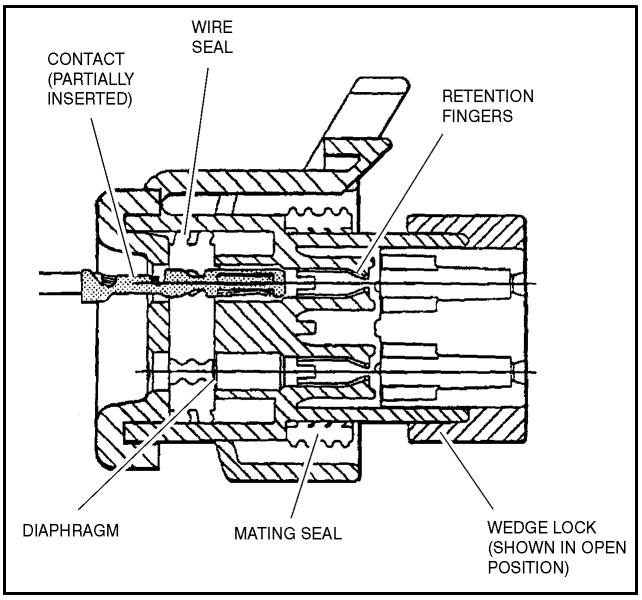


Figure 6-6. Connector Assembly (1 of 4)

1. To insert a contact, push it straight into the appropriate circuit cavity as far as it will go (See Figure 6-7. Connector Assembly (2 of 4)).
2. Pull back on the contact wire with a force of 1 or 2 lbs. to be sure the retention fingers are holding the contact (See Figure 6-7. Connector Assembly (2 of 4)).
3. After all required contacts have been inserted, the wedge lock must be closed to its locked position. Release the locking latches by squeezing them inward (See Figure 6-8. Connector Assembly (3 of 4)).
4. Slide the wedge lock into the housing until it is flush with the housing (See Figure 6-9. Connector Assembly (4 of 4)).

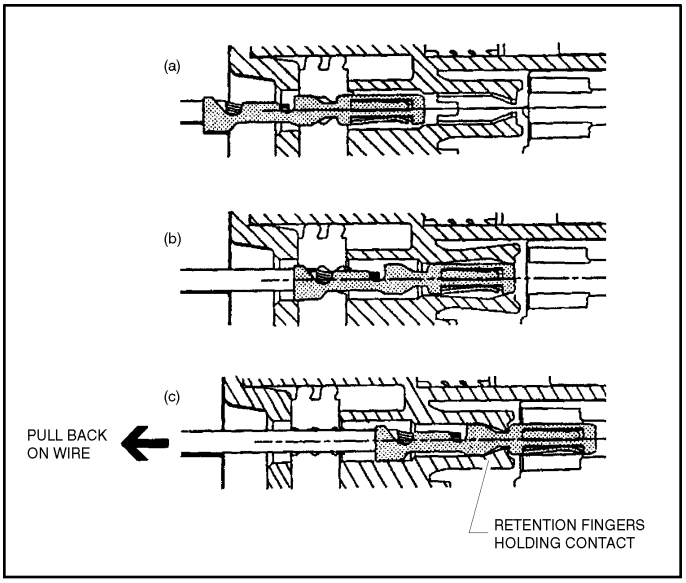


Figure 6-7. Connector Assembly (2 of 4)

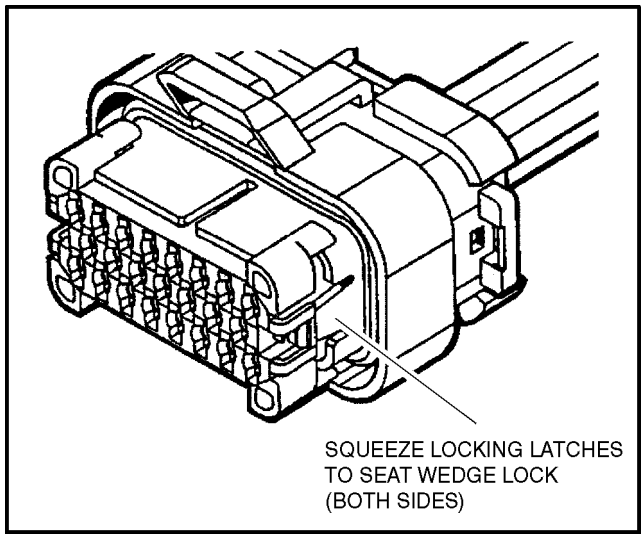


Figure 6-8. Connector Assembly (3 of 4)

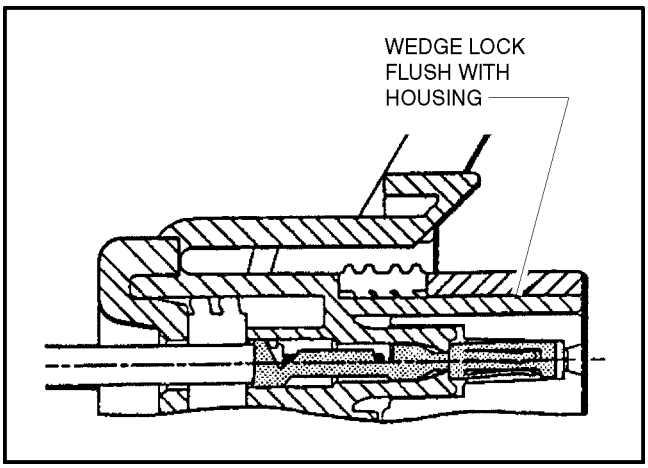


Figure 6-9. Connector Assembly (4 of 4)

Disassembly

5. Insert a 4.8 mm (3/16”) wide screwdriver blade between the mating seal and one of the red wedge lock tabs.
6. Pry open the wedge lock to the open position.
7. While rotating the wire back and forth over a half turn (1/4 turn in each direction), gently pull the wire until the contact is removed.

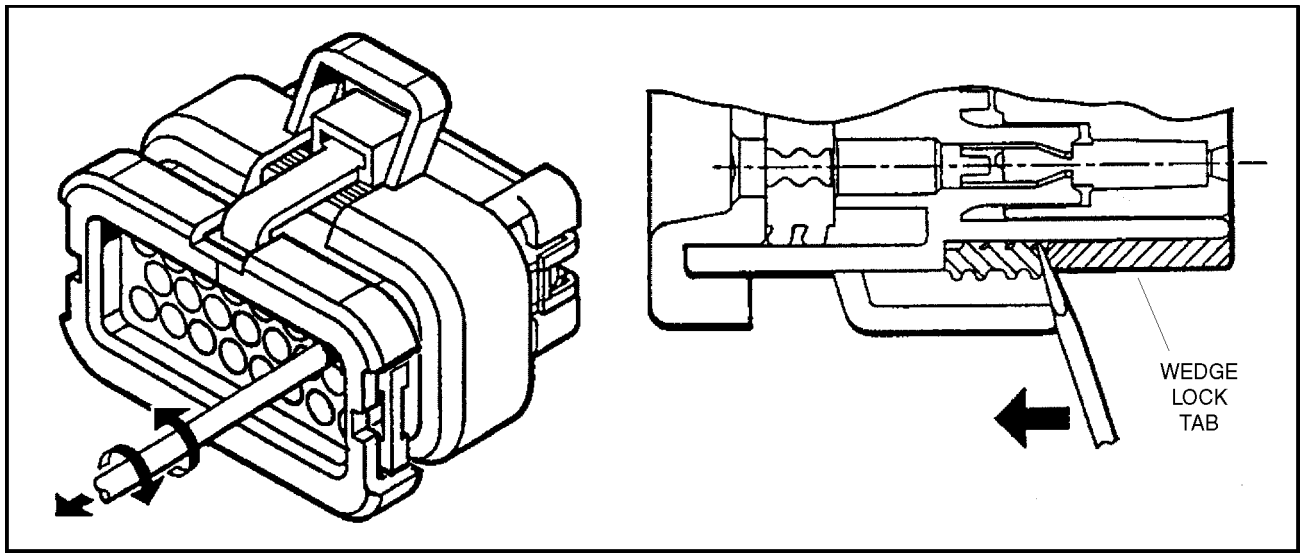


Figure 6-10. Connector Disassembly

NOTE: *The wedge lock should never be removed from the housing for insertion or removal of the contacts.*

Wedge Lock

The wedge lock has slotted openings in the forward, or mating end. These slots accommodate circuit testing in the field, by using a flat probe such as a pocket knife. DO NOT use a sharp point such as an ice pick.

Service - Voltage Reading

⚠ CAUTION

DO NOT PIERCE WIRE INSULATION TO TAKE VOLTAGE READINGS.

It has been common practice in electrical troubleshooting to probe wires by piercing the insulation with a sharp point. This practice should be discouraged when dealing with the AMPSEAL plug assembly, or any other sealed connector system. The resulting pinholes in the insulation will allow moisture to invade the system by traveling along the wire strands. This nullifies the effectiveness of the connector seals and could result in system failure.

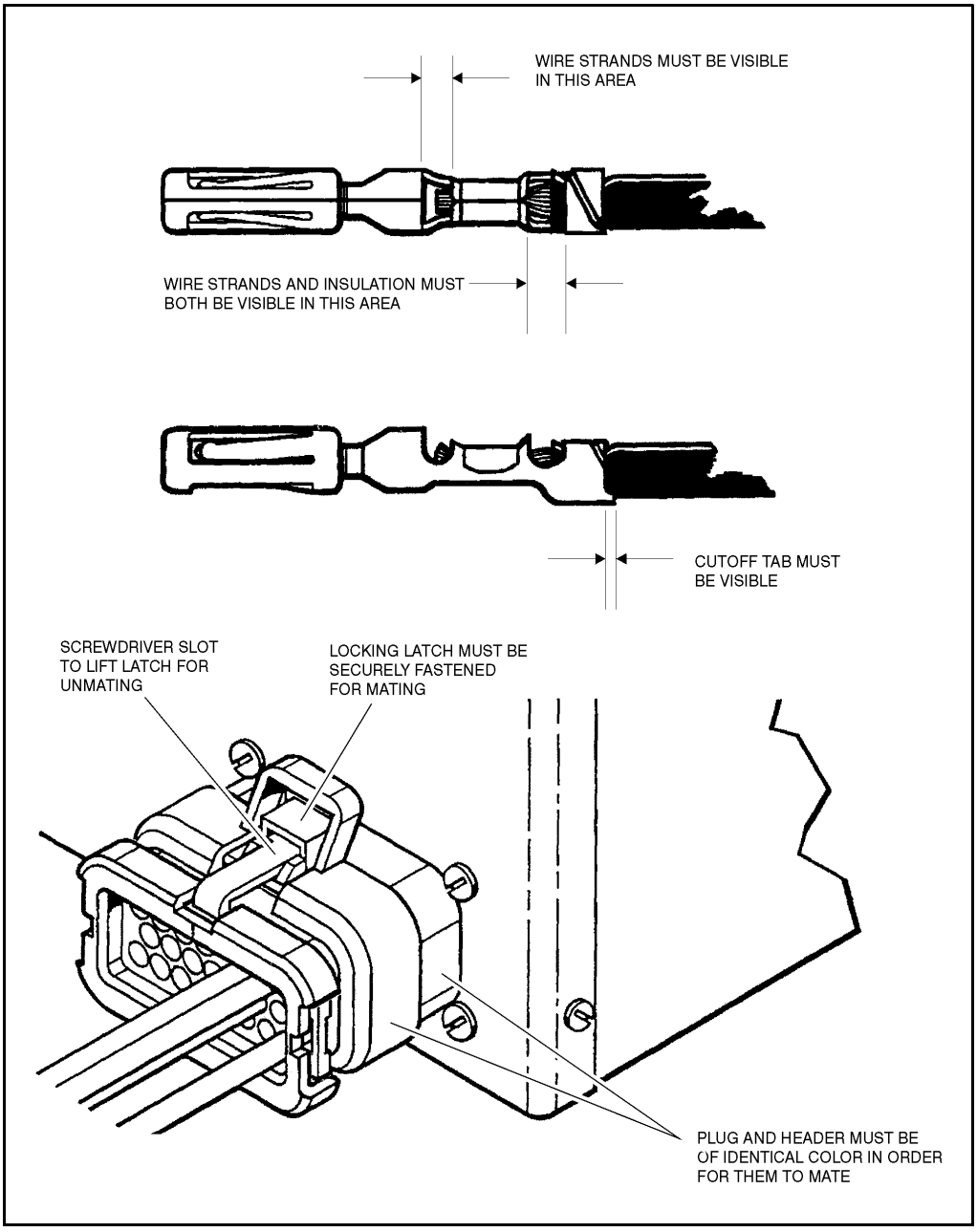

WIRE STRANDS MUST BE VISIBLE IN THIS AREA
WIRE STRANDS AND INSULATION MUST BOTH BE VISIBLE IN THIS AREA
CUTOFF TAB MUST BE VISIBLE
SCREWDRIVER SLOT TO LIFT LATCH FOR UNMATING
LOCKING LATCH MUST BE SECURELY FASTENED FOR MATING
PLUG AND HEADER MUST BE OF IDENTICAL COLOR IN ORDER FOR THEM TO MATE

Figure 6-11. Connector Installation

6.4 WORKING WITH DEUTSCH CONNECTORS

DT/DTP Series Assembly

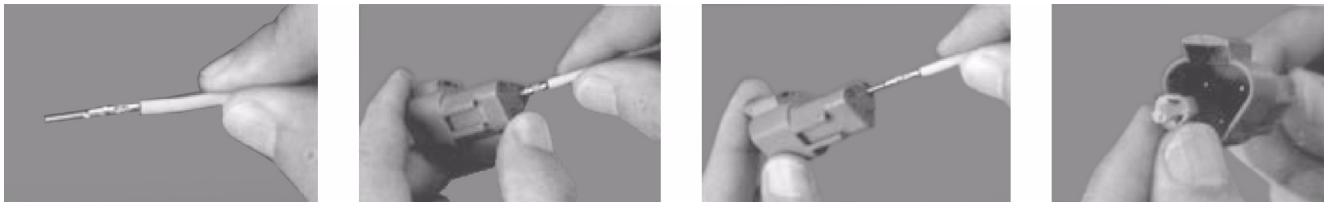


Figure 6-12. DT/DTP Contact Installation

1. Grasp crimped contact about 25mm behind the contact barrel.
2. Hold connector with rear grommet facing you.
3. Push contact straight into connector grommet until a click is felt. A slight tug will confirm that it is properly locked in place.
4. Once all contacts are in place, insert wedgelock with arrow pointing toward exterior locking mechanism. The wedge-lock will snap into place. Rectangular wedges are not oriented. Thy may go in either way.

NOTE: *The receptacle is shown - use the same procedure for plug.*

DT/DTP Series Disassembly

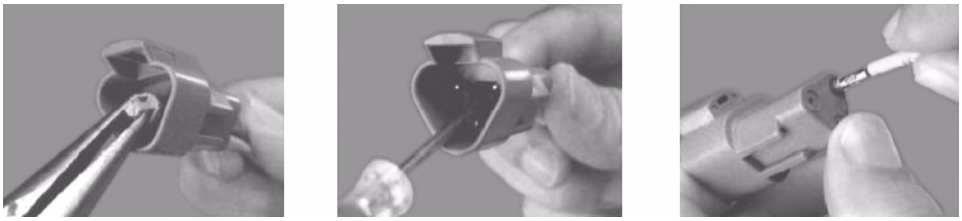


Figure 6-13. DT/DTP Contact Removal

5. Remove wedgelock using needlenose pliers or a hook shaped wire to pull wedge straight out.
6. To remove the contacts, gently pull wire backwards, while at the same time releasing the locking finger by moving it away from the contact with a screwdriver.
7. Hold the rear seal in place, as removing the contact may displace the seal.

HD30/HDP20 Series Assembly

Figure 6-14. HD/HDP Contact Installation

8. Grasp contact about 25mm behind the contact crimp barrel.
9. Hold connector with rear grommet facing you.

10. Push contact straight into connector grommet until a positive stop is felt. A slight tug will confirm that it is properly locked in place.

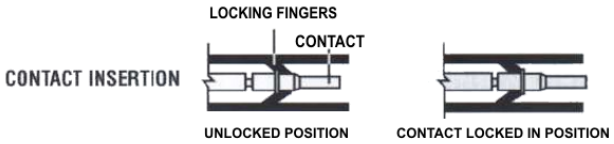


Figure 6-15. HD/HDP Locking Contacts Into Position

NOTE: *For unused wire cavities, insert sealing plugs for full environmental sealing*

HD30/HDP20 Series Disassembly

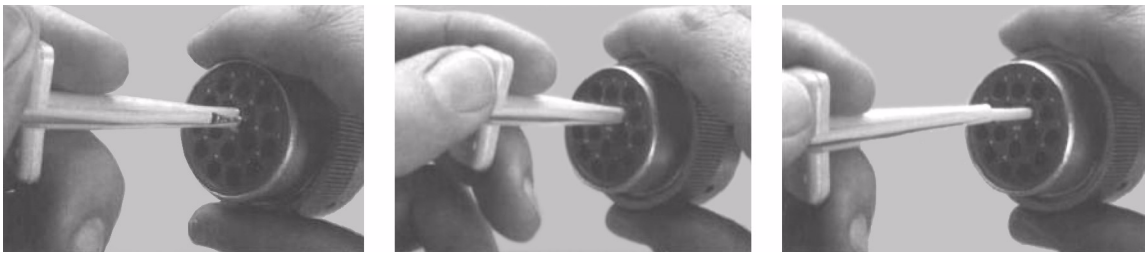


Figure 6-16. HD/HDP Contact Removal

11. With rear insert toward you, snap appropriate size extractor tool over the wire of contact to be removed.
12. Slide tool along into the insert cavity until it engages contact and resistance is felt.
13. Pull contact-wire assembly out of connector.

Figure 6-17. HD/HDP Unlocking Contacts

NOTE: *Do Not twist or insert tool at an angle.*

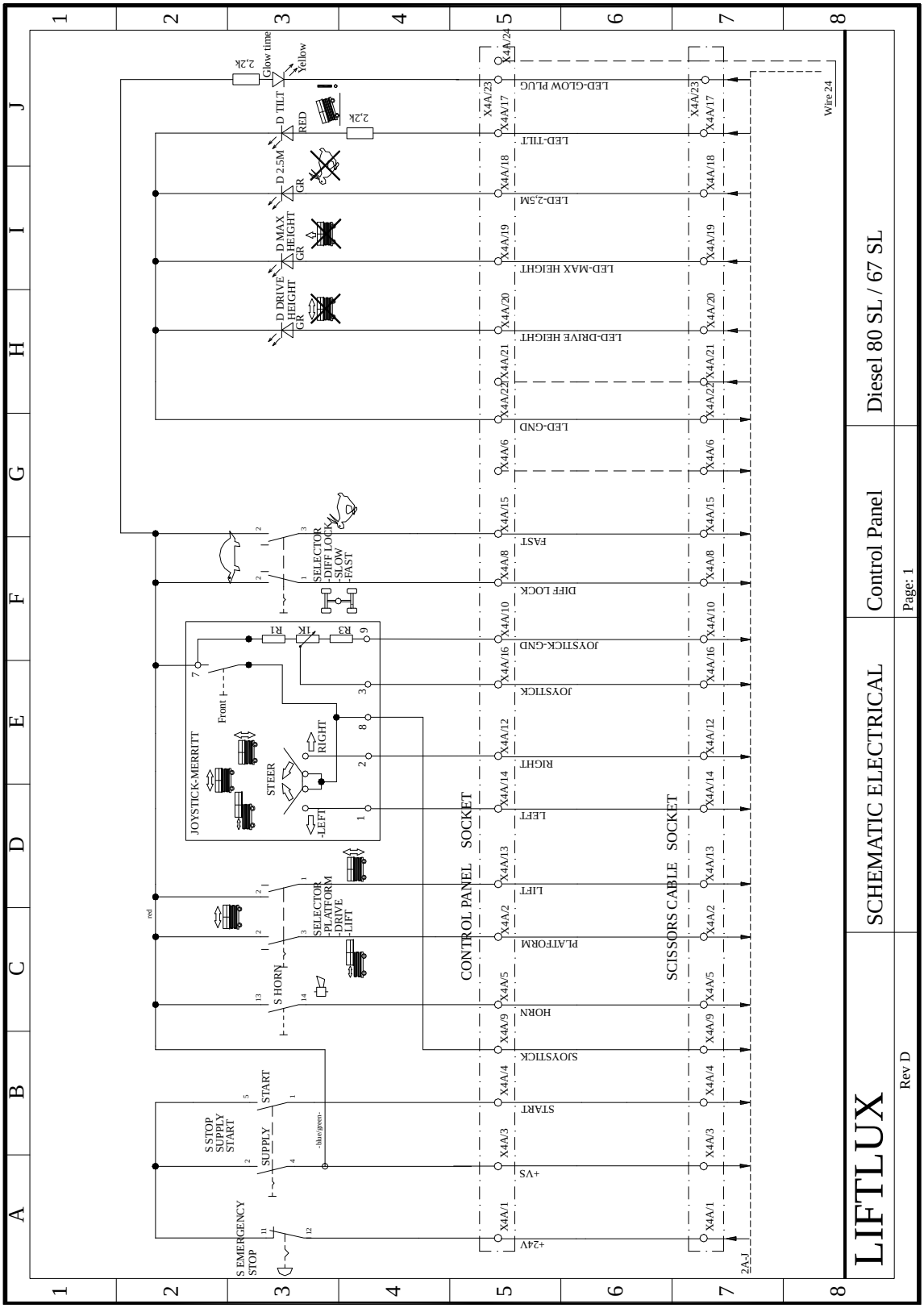


Figure 6-18. Electrical Schematic - Sheet 1 of 15

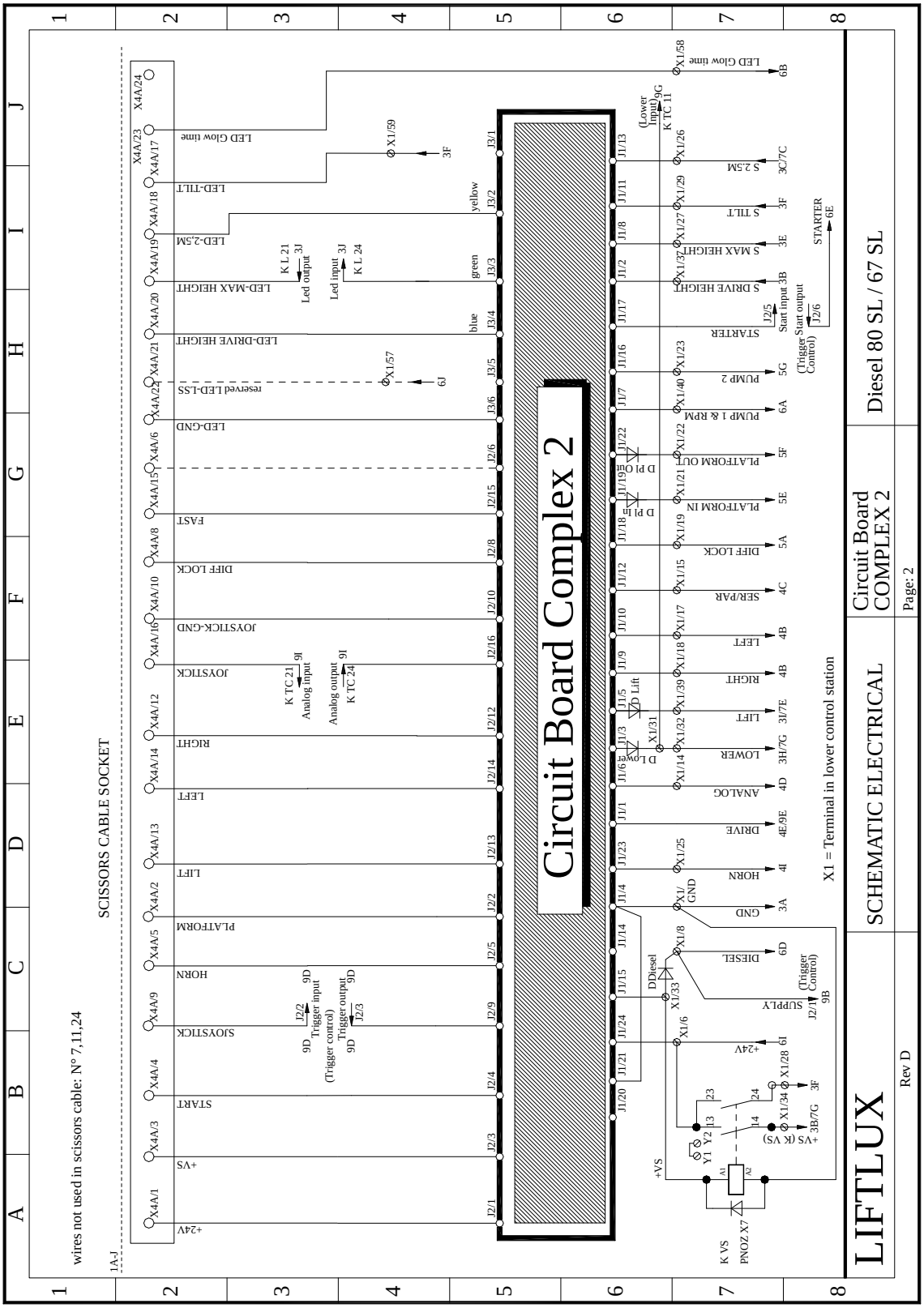


Figure 6-19. Electrical Schematic - Sheet 2 of 15

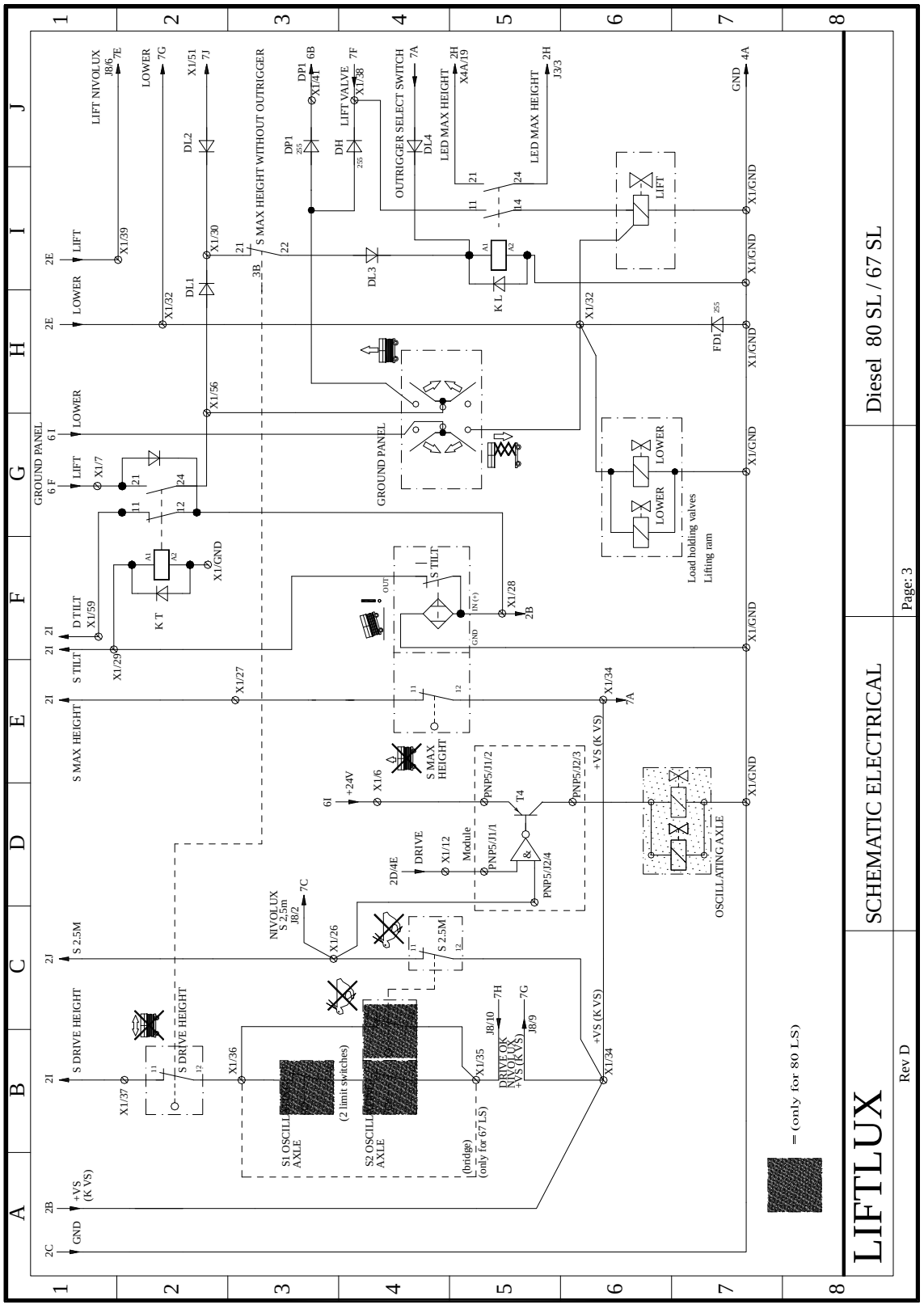


Figure 6-20. Electrical Schematic - Sheet 3 of 15

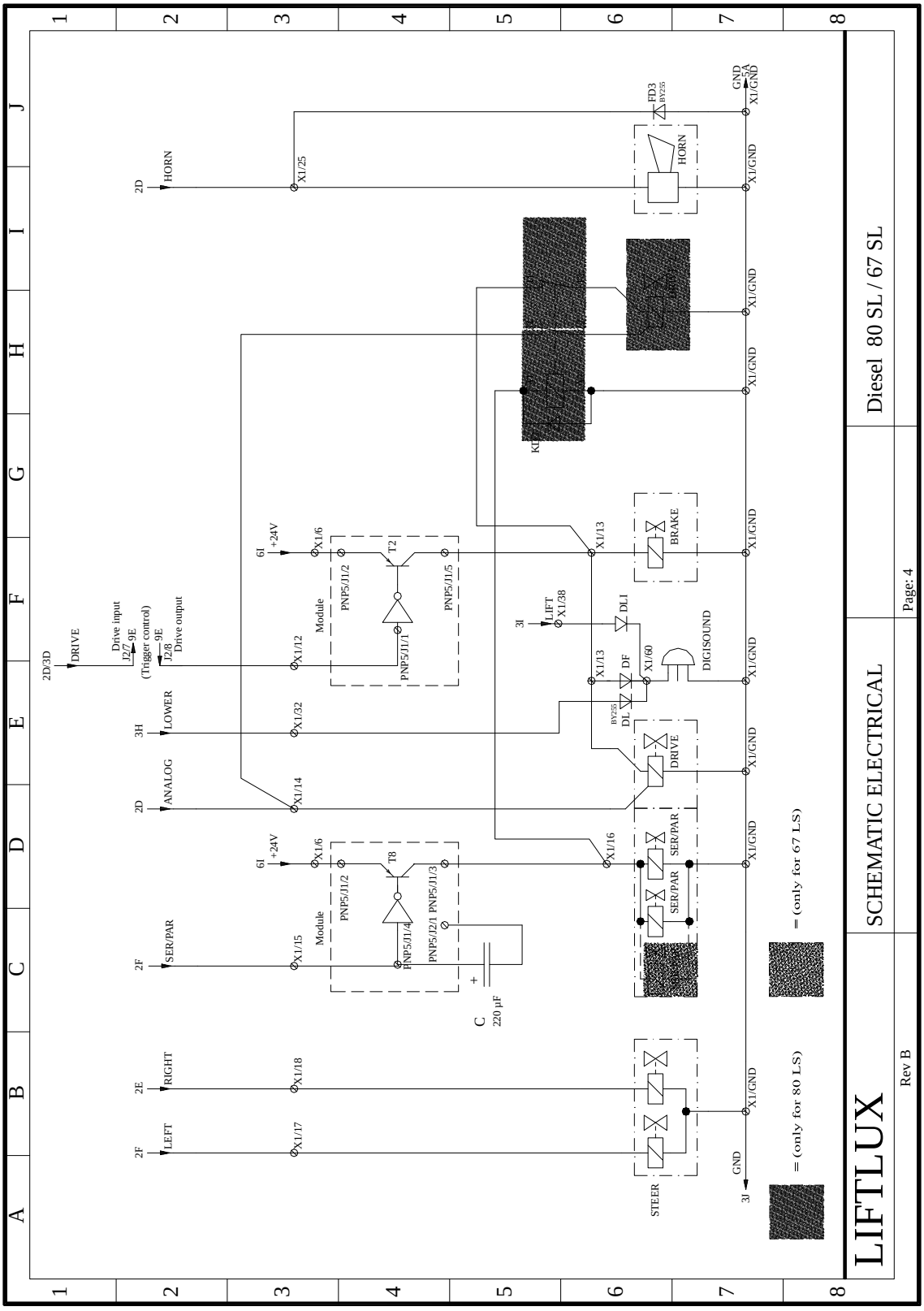


Figure 6-21. Electrical Schematic - Sheet 4 of 15

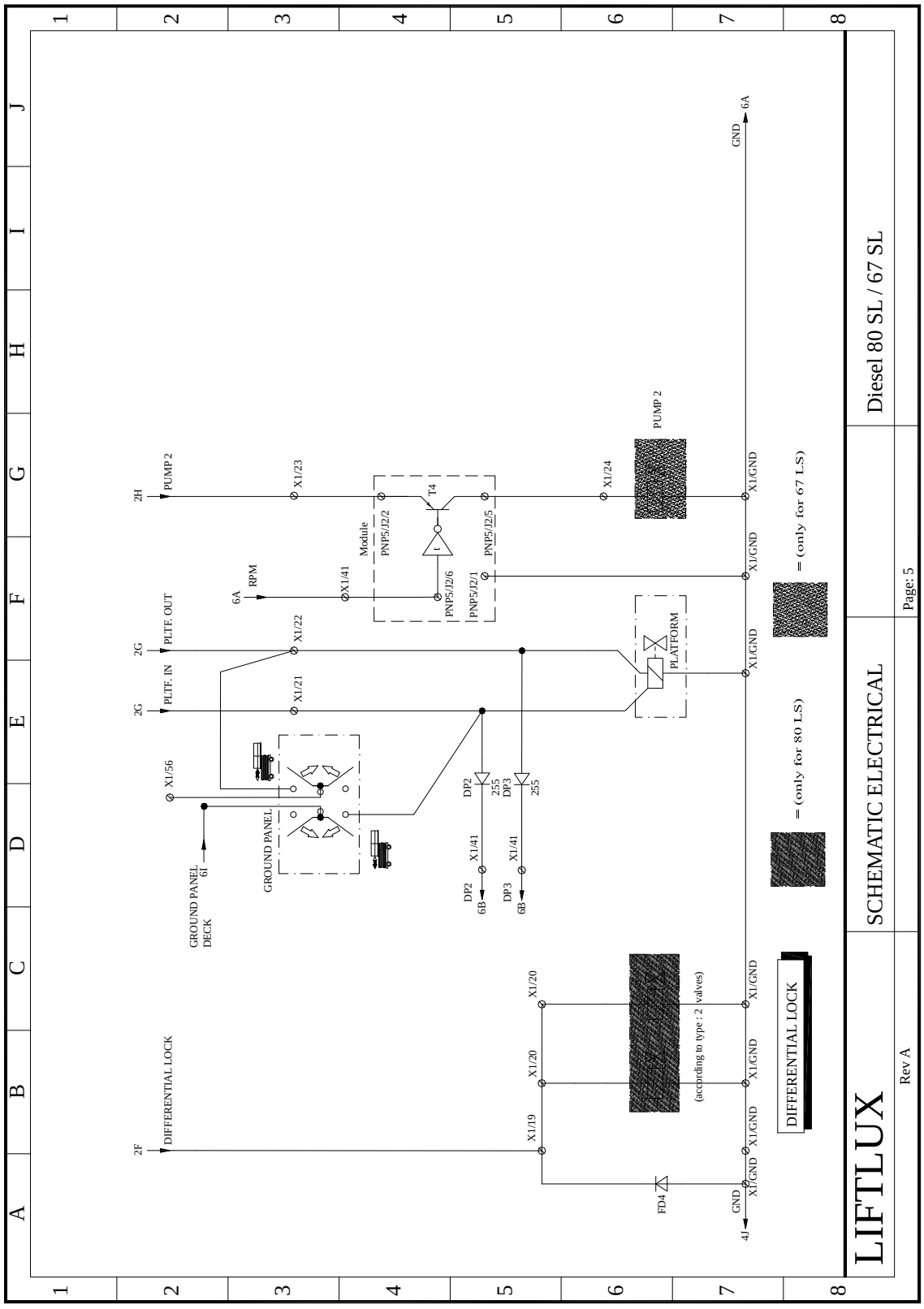


Figure 6-22. Electrical Schematic - Sheet 5 of 15

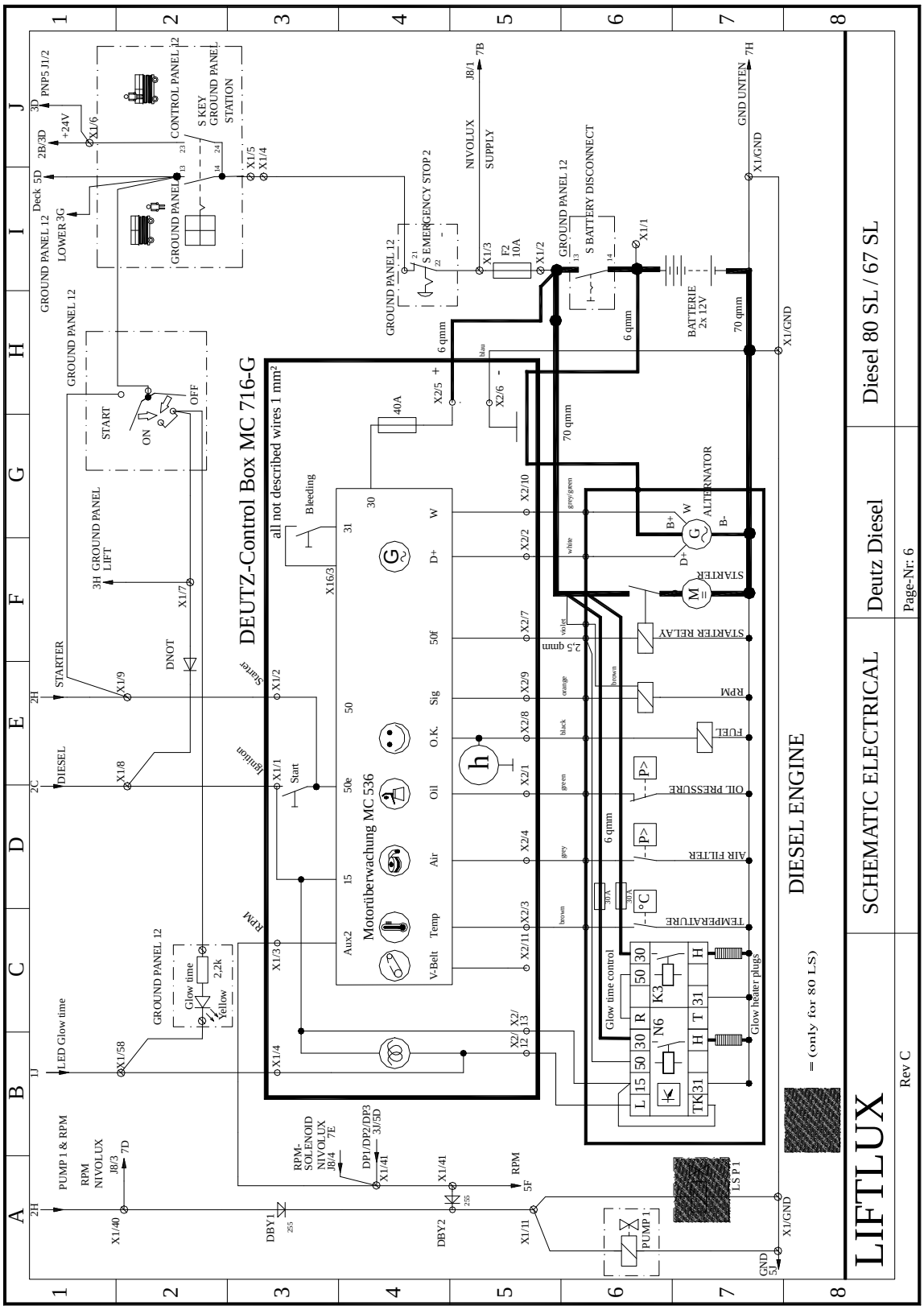


Figure 6-23. Electrical Schematic - Sheet 6 of 15

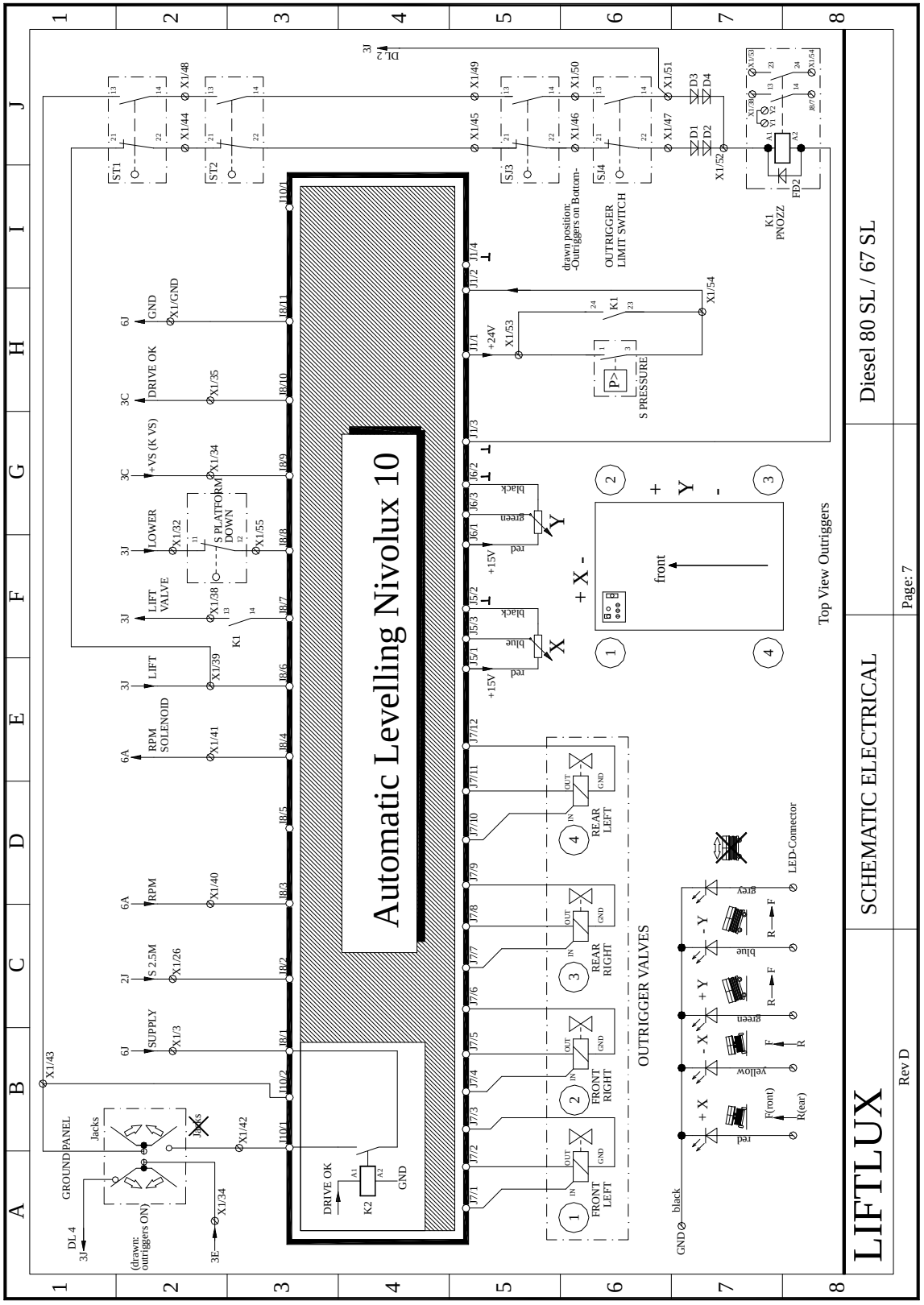


Figure 6-24. Electrical Schematic - Sheet 7 of 15

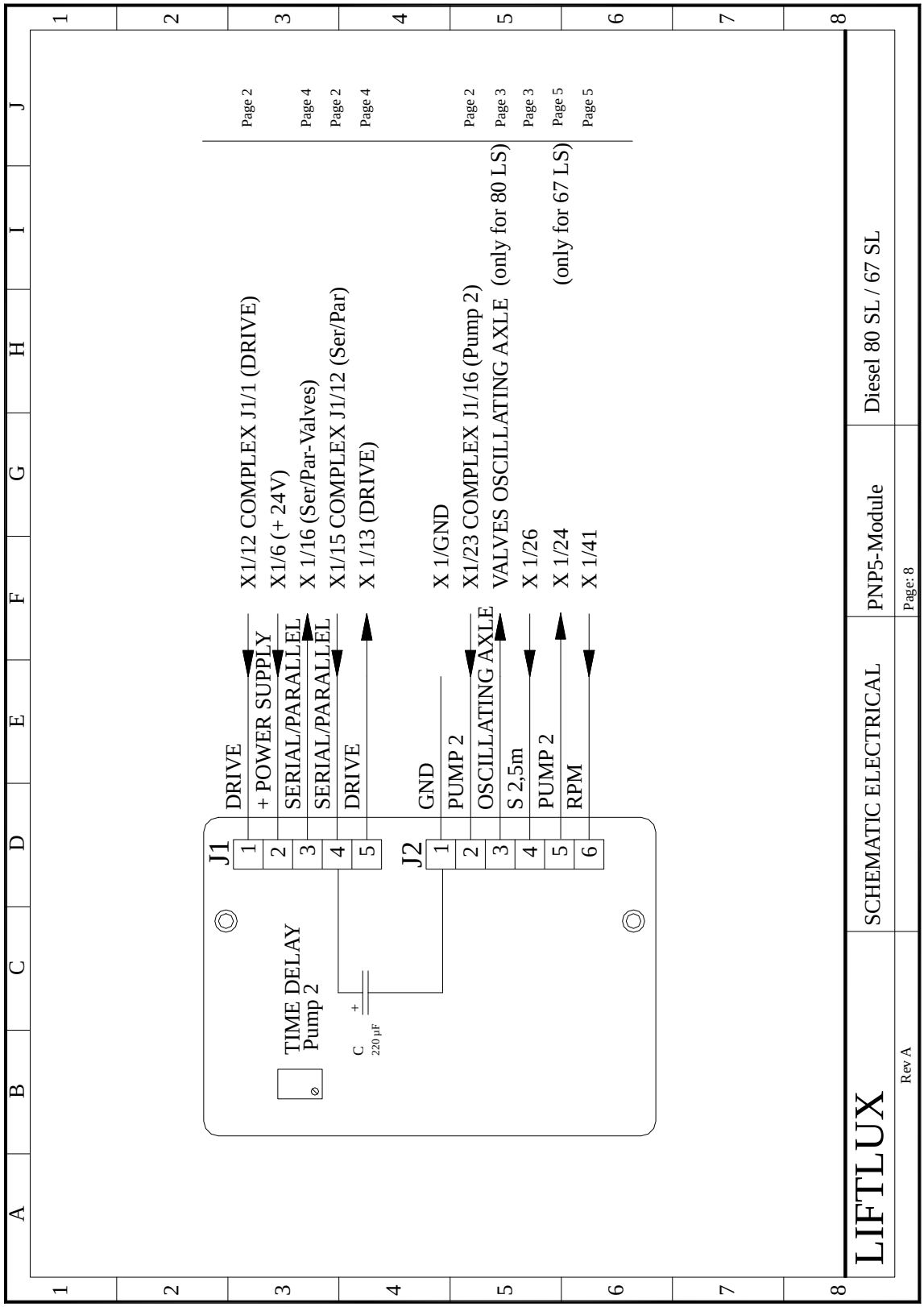


Figure 6-25. Electrical Schematic - Sheet 8 of 15

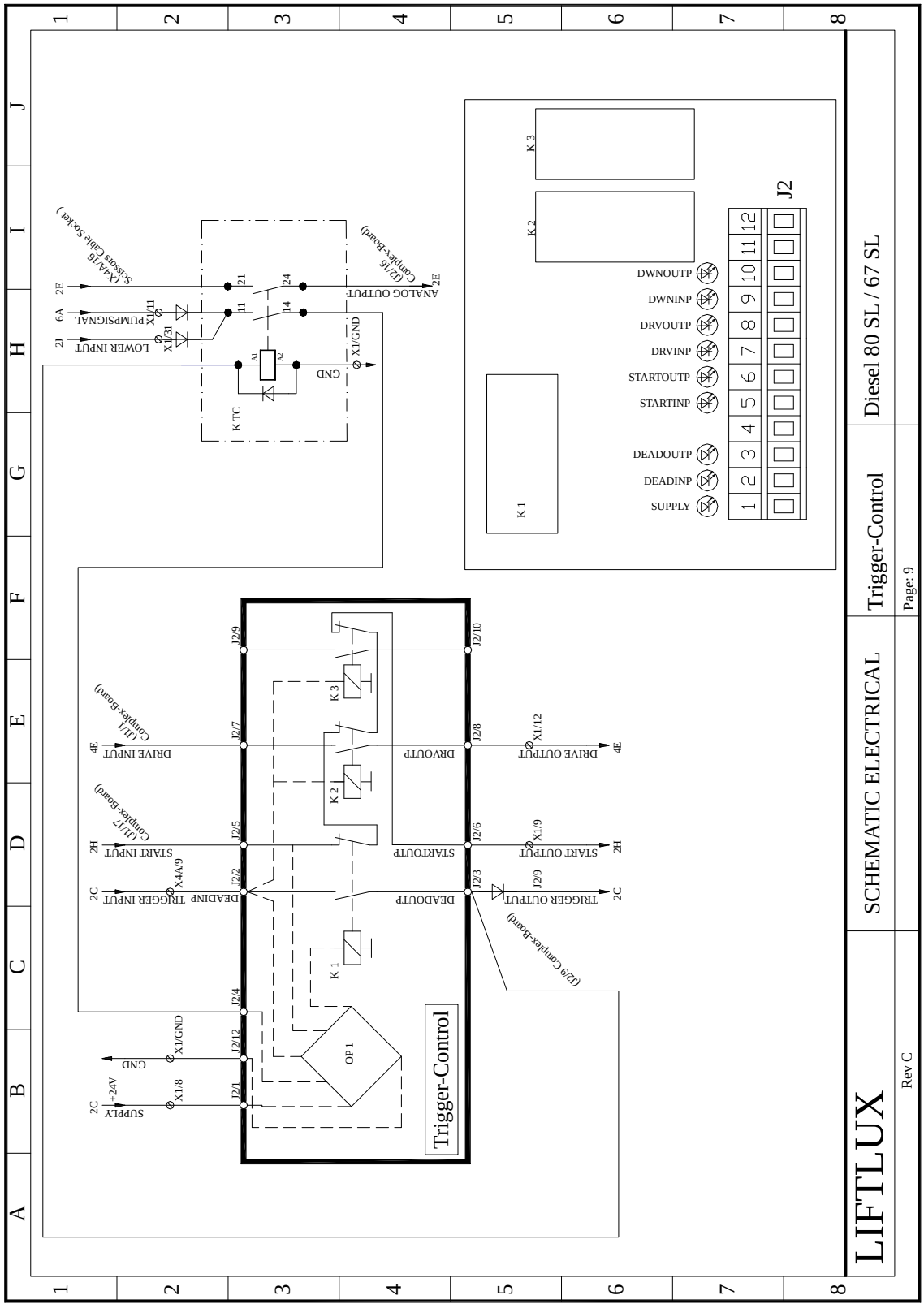


Figure 6-26. Electrical Schematic - Sheet 9 of 15

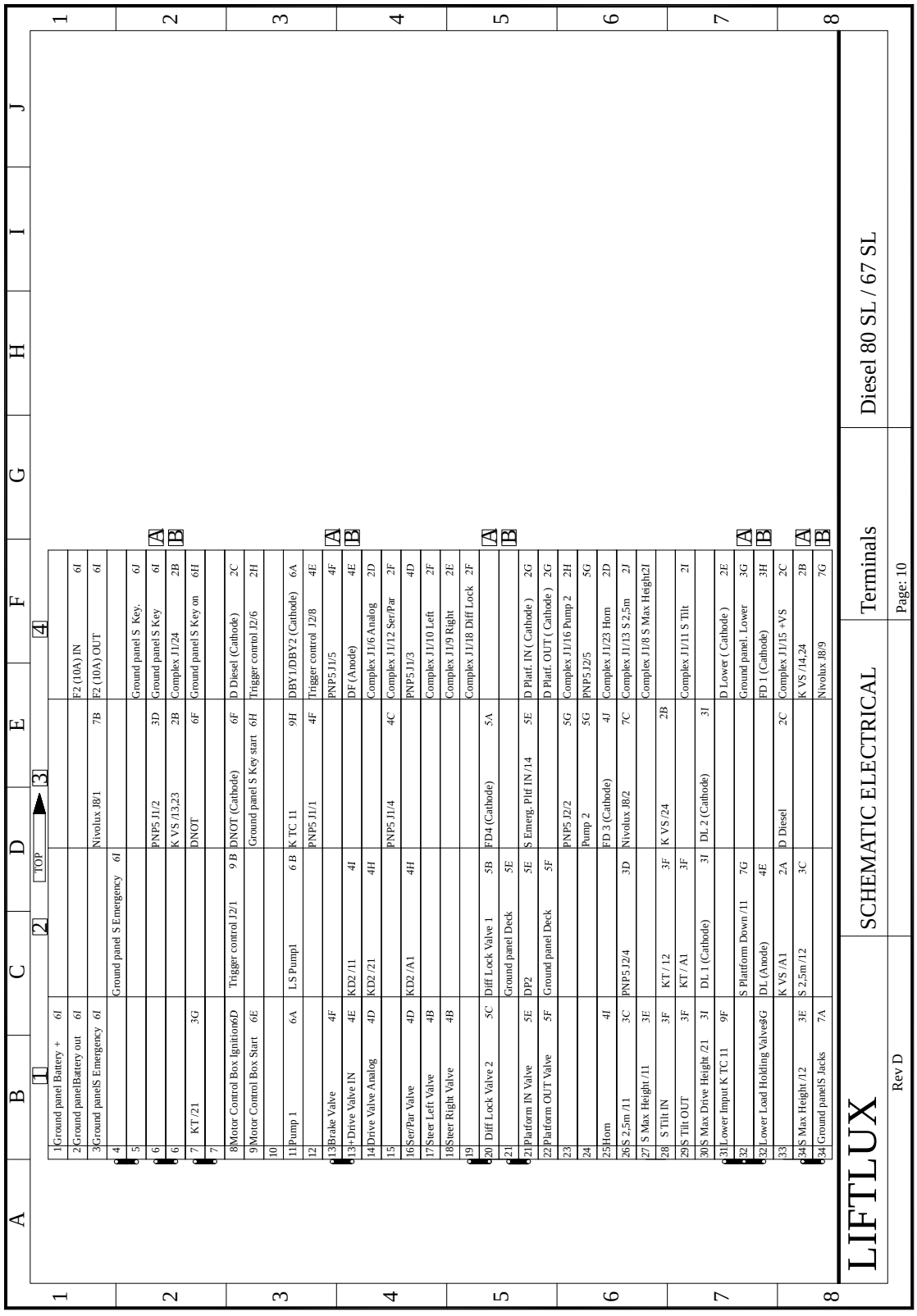


Figure 6-27. Electrical Schematic - Sheet 10 of 15

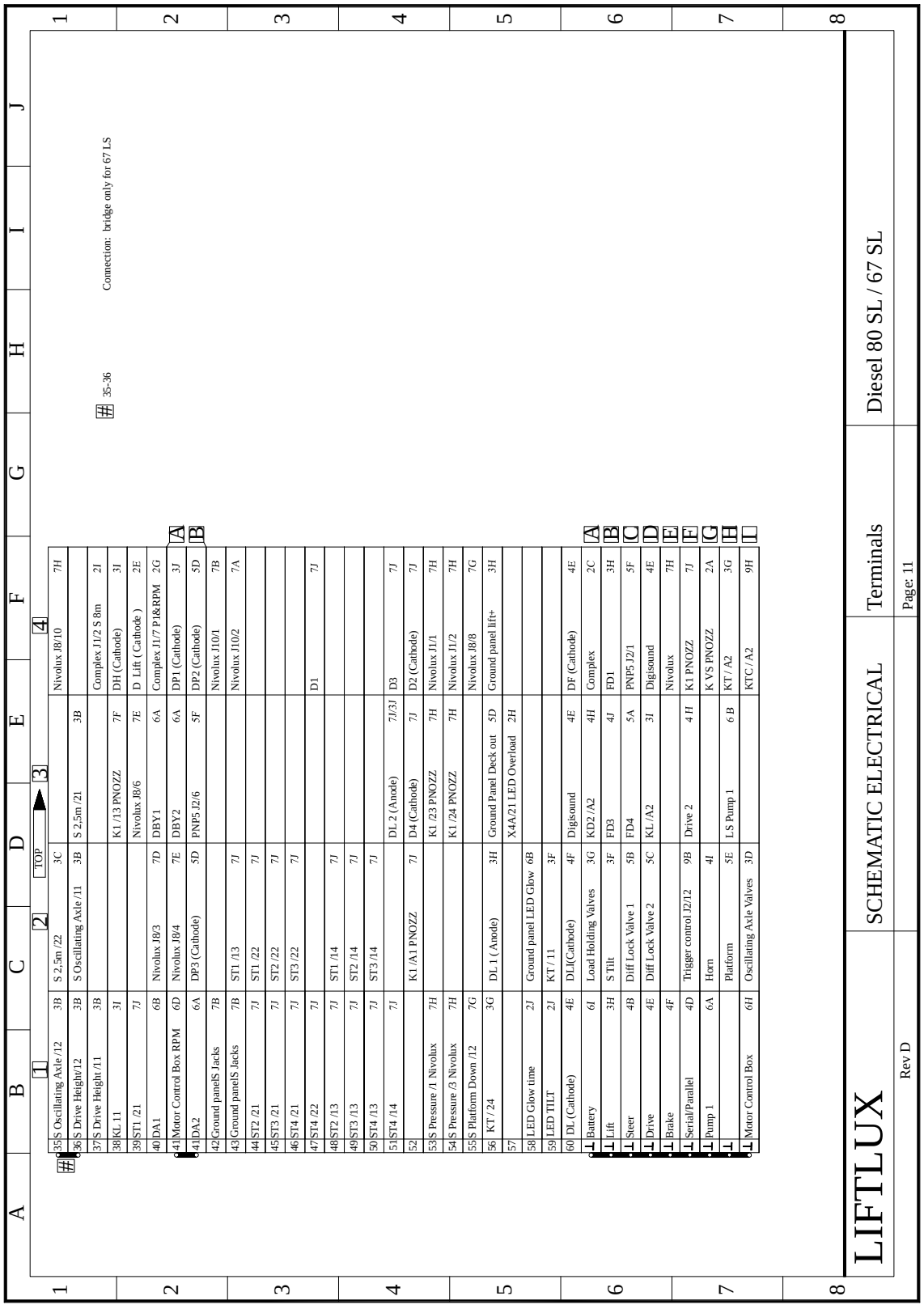

LIFTLUX
SCHEMATIC ELECTRICAL
Terminals
Diesel 80 SL / 67 SL
Rev D
Page: 11
Connection: bridge only for 67 LS
35-36
TOP
1 2 3 4
35 S Oscillating Axle /12 3B S 2,5m /22 3C Nivolux J8/10 7H
36 S Drive Height/12 3B S Oscillating Axle /11 3B S 2,5m /21 3B
37 S Drive Height /11 3B Complex J1/2 S 8m 2I
38 KL 11 3I K1 /13 PNOZZ 7F DH (Cathode) 3I
39 ST1 /21 7J Nivolux J8/6 7E D Lift (Cathode) 2E
40 DA1 6B Nivolux J8/3 7D DBY1 6A Complex J1/7 PI&RPM 2G
41 Motor Control Box RPM 6D Nivolux J8/4 7E DBY2 6A DP1 (Cathode) 3J A
42 DA2 6A DP3 (Cathode) 5D PNP5 J2/6 5F DP2 (Cathode) 5D B
43 Ground panelS Jacks 7B Nivolux J10/1 7B
44 Ground panelS Jacks 7B ST1 /13 7J Nivolux J10/2 7A
45 ST2 /21 7J ST1 /22 7J
46 ST3 /21 7J ST2 /22 7J
47 ST4 /21 7J ST3 /22 7J
48 ST4 /22 7J D1 7J
49 ST2 /13 7J ST1 /14 7J
50 ST3 /13 7J ST2 /14 7J
51 ST4 /13 7J ST3 /14 7J
52 ST4 /14 7J DL 2 (Anode) 7J/3J D3 7J
53 S Pressure /1 Nivolux 7H K1 /A1 PNOZZ 7J D4 (Cathode) 7J D2 (Cathode) 7J
54 S Pressure /3 Nivolux 7H K1 /23 PNOZZ 7H Nivolux J1/1 7H
55 S Platform Down /12 7G K1 /24 PNOZZ 7H Nivolux J1/2 7H
56 KT / 24 3G DL 1 (Anode) 3H Ground Panel Deck out 5D Nivolux J8/8 7G
57 X4A/21 LED Overload 2H Ground panel lift+ 3H
58 LED Glow time 2J Ground panel LED Glow 6B
59 LED TILT 2J KT / 11 3F
60 DL (Cathode) 4E DLf(Cathode) 4F Digisound 4E DF (Cathode) 4E
Battery 6I Load Holding Valves 3G KD2 /A2 4H Complex 2C A
Lift 3H S Tilt 3F FD3 4J FD1 3H B
Steer 4B Diff Lock Valve 1 5B FD4 5A PNP5 J2/1 5F C
Drive 4E Diff Lock Valve 2 5C K1 /A2 3I Digisound 4E D
Brake 4F Nivolux 7H E
Serial/Parallel 4D Trigger control J2/12 9B Drive 2 4 H K1 PNOZZ 7J F
Pump 1 6A Horn 4I K VS PNOZZ 2A G
Platform 5E L5 Pump 1 6 B KT / A2 3G H
Motor Control Box 6H Oscillating Axle Valves 3D KTC / A2 9H I

Figure 6-28. Electrical Schematic - Sheet 11 of 15

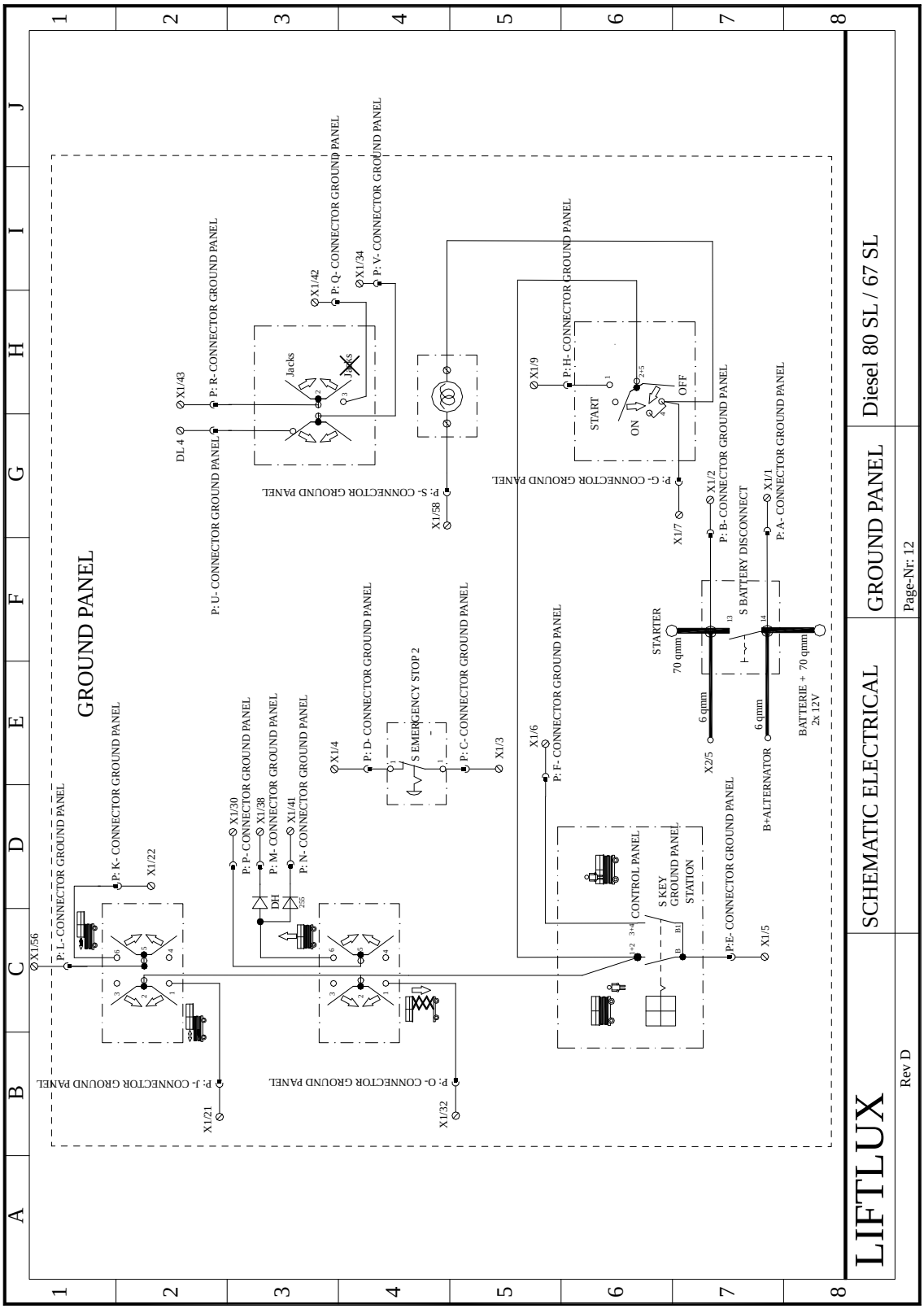


Figure 6-29. Electrical Schematic - Sheet 12 of 15

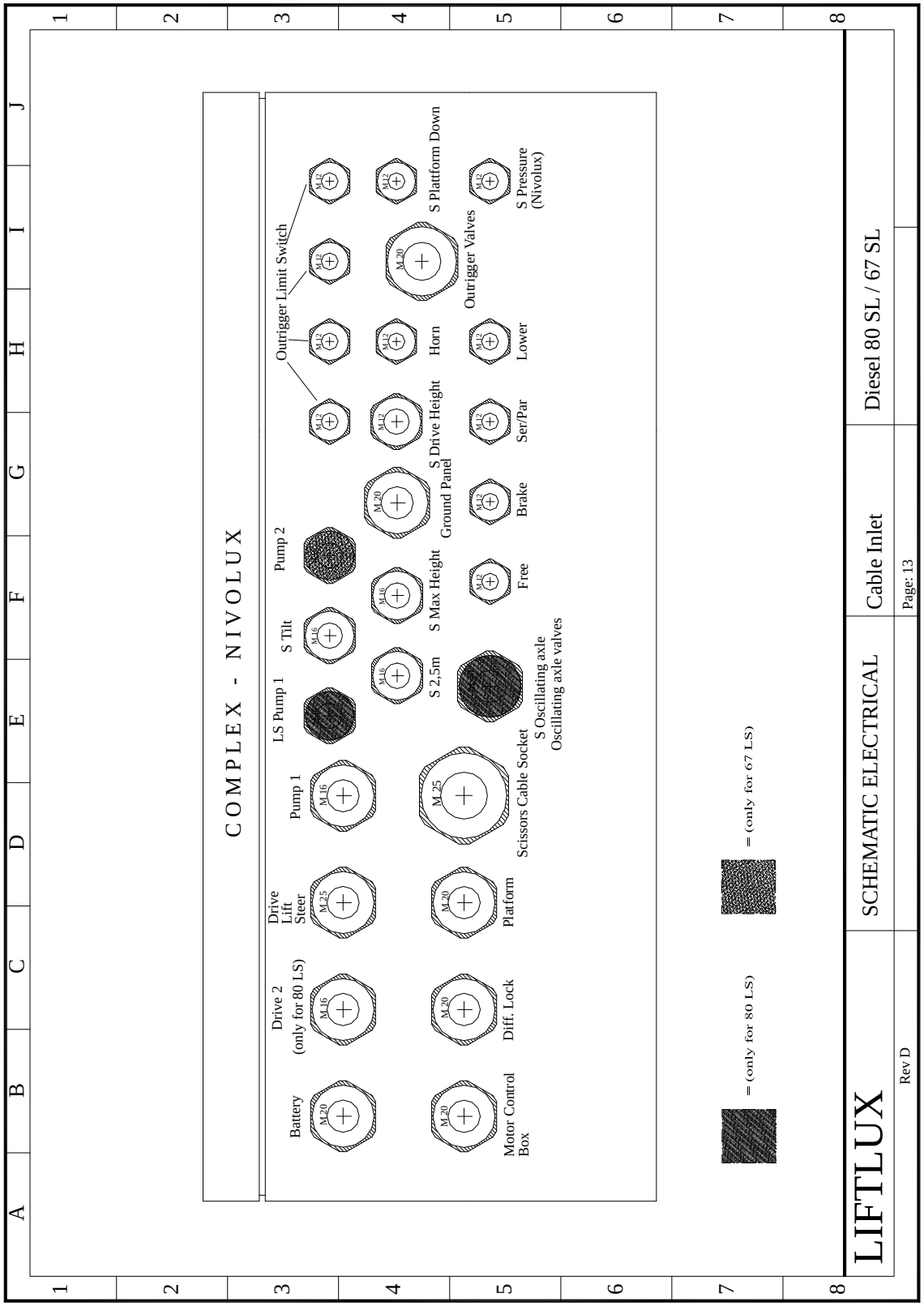


Figure 6-30. Electrical Schematic - Sheet 13 of 15

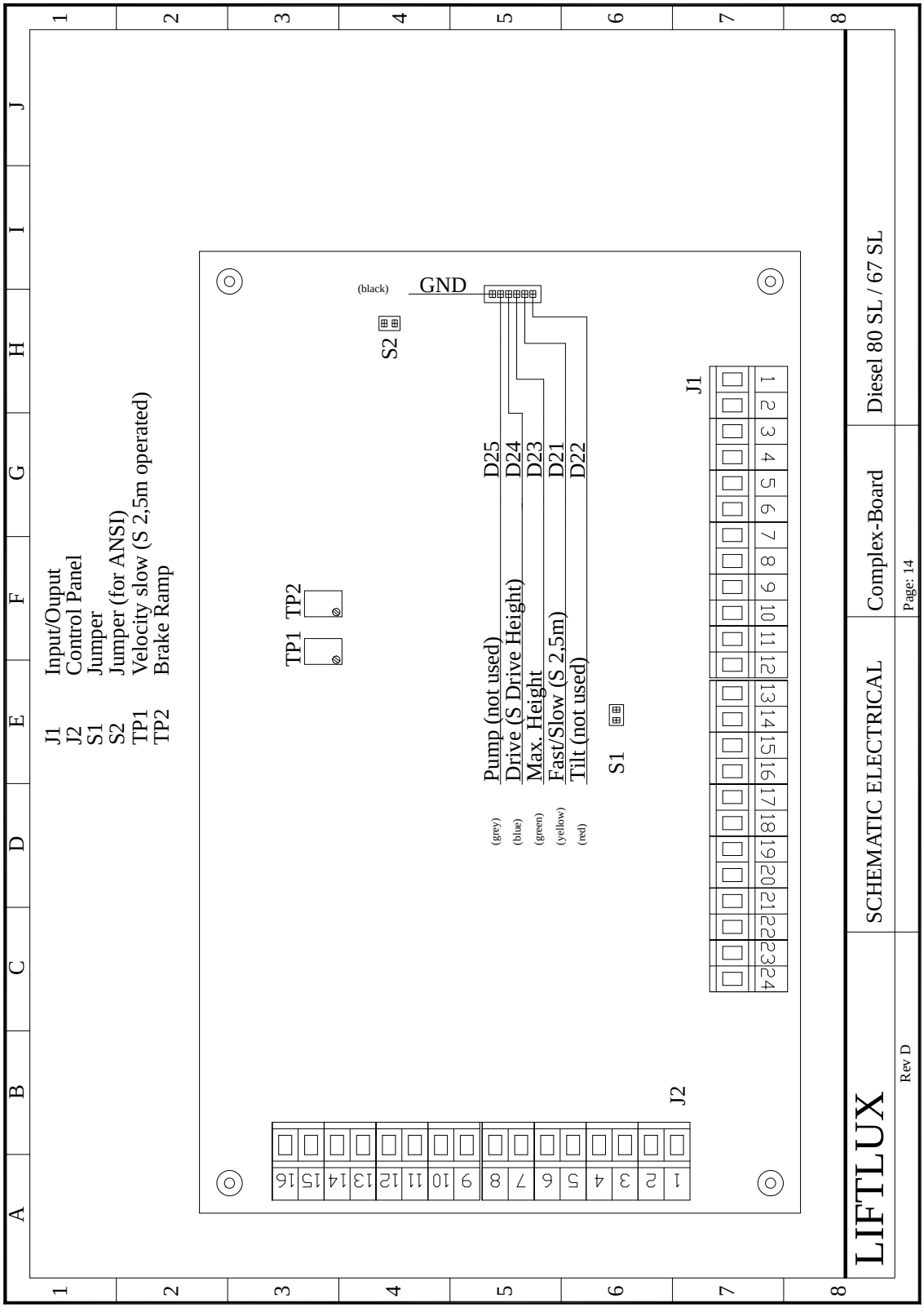


Figure 6-31. Electrical Schematic - Sheet 14 of 15

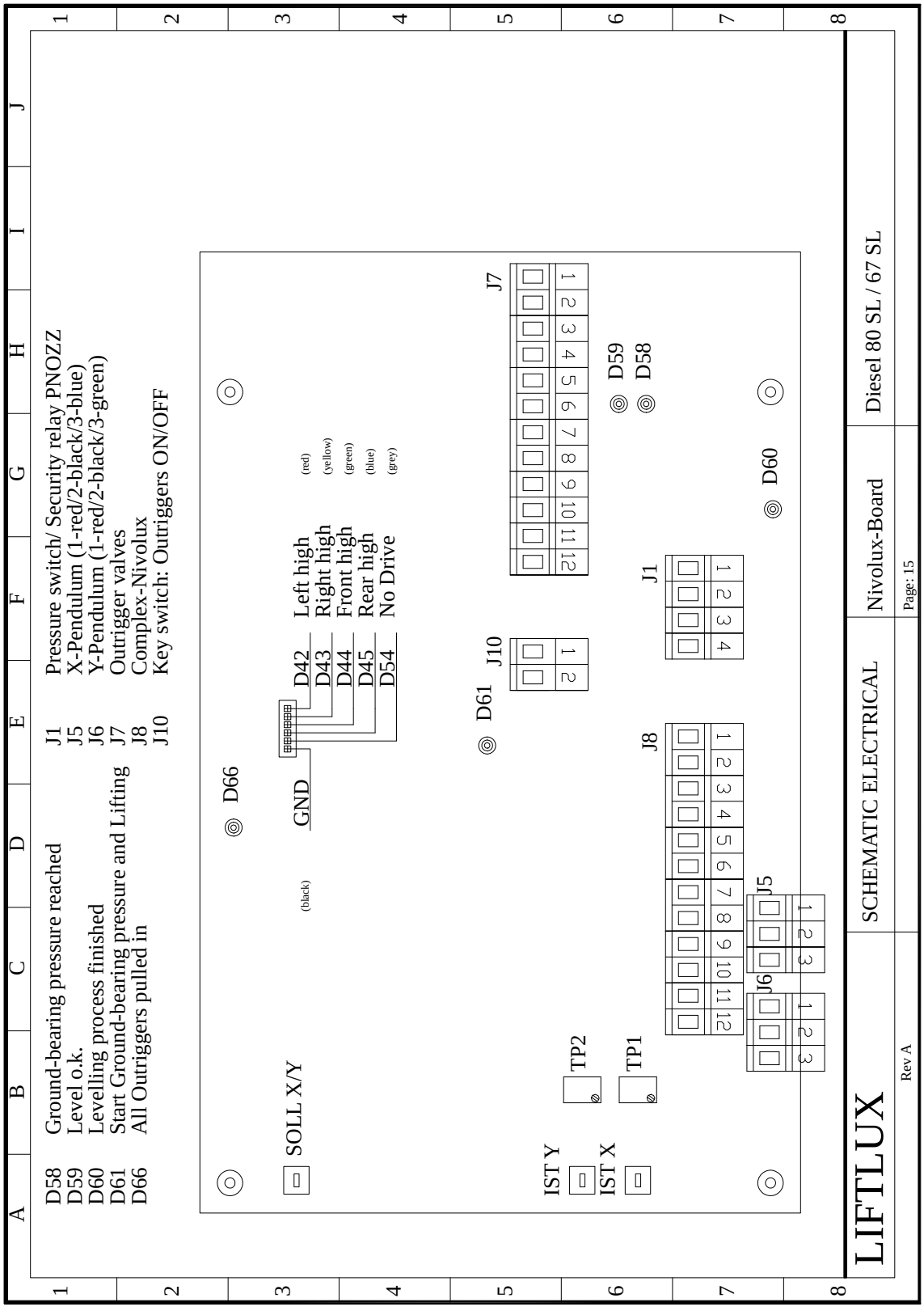


Figure 6-32. Electrical Schematic - Sheet 15 of 15

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Type	Position 1	Position 2	Label (External Harness)
1	UL1569 18OR	X1/12-3	PNP5 J1/1	
2	UL1569 18R	X1/6A-3	PNP5 J1/2	
3	UL1569 18GR	X1/16-4	PNP5 J1/3	
4	UL1569 18BR	X1/13A-4	PNP5 J1/5	
5	UL1569 18P	X1/15-3	PNP5 J1/4	
6	UL1569 18P	ELCO/+	PNP5 J1/4	
7	UL1569 18BL	ELCO/-	PNP5 J2/1	
8	UL1569 18BL	X1/C-4	PNP5 J2/1	
9	UL1569 18G	X1/23-3	PNP5 J2/2	
10	UL1569 18GN	X1/26-3	PNP5 J2/4	
11	UL1569 18W	X1/24-4	PNP5 J2/5	
12	UL1569 18ZW	X1/41B-3	PNP5 J2/6	
13	UL1569 18GR	X1/33-2	K VS/A1	
14	UL1569 18GR	X1/G-4	K VS/A2	
15	UL1569 18GR	X1/6B-3	K VS/13	
16	UL1569 18GR	K VS/23	K VS/13	
17	UL1569 18GR	X1/34 A-4	K VS/14	
18	UL1569 18GR	X1/28-3	K VS/24	
20	UL1569 18GR	X1/11-3	D20/A	
136	UL1569 18GR	K TC/11	D20/K	
135	UL1569 18GR	trig contr J2/4	K TC/14	
21	UL1569 18GR	X1/16-3	KD2/A1	
22	UL1569 18GR	X1/A-3	KD2/A2	
23	UL1569 18GR	X1/14-3	KD2/21	
24	UL1569 18GR	X1/13B-3	KD2/11	
25	UL1569 18GR	X1/56-3	KT/24	
26	UL1569 18GR	X1/7A-1	KT/21	
27	UL1569 18GR	X1/F-2	trig contr J2/12	
28	UL1569 18GR	trig contr J2/1	X1/8-2	
29	UL1569 18GR	X1/28-2	KT/12	
30	UL1569 18GR	X1/59-2	KT/11	
31	UL1569 18GR	X1/H-4	KT/A2	
32	UL1569 18GR	X1/29-3	KT/A1	
33	UL1569 18R	DIODE3/K	X1/60-1	
34	UL1569 18BR	DIODE3/A	X1/32B-2	
35	UL1569 18BL	X1/D-4	BUZ/2	
36	UL1569 18R	DIODE4/K	X1/60-4	
37	UL1569 18BR	DIODE4/A	X1/13B-4	
132	UL1569 18R	DIODE6/K	X1/60-2	
133	UL1569 18BR	DIODE6/A	X1/38-2	
134	UL1569 18GR	X1/60-3	BUZ/1	

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Type	Position 1	Position 2	Label (External Harness)
38	UL1569 18R	K1/Y1	K1/Y2	
129	UL1569 18R	K VS/Y1	K VS/Y2	
39	UL1569 18BL	X1/54-3	K1/24	
40	UL1569 18P	X1/53-3	K1/23	
41	UL1569 18W	X1/38-3	K1/13	
42	UL1569 18R	K1/A1	DIODE5/K	
43	UL1569 18BL	K1/A2	DIODE5/A	
44	UL1569 18R	K1/A1	X1/52-2	
45	UL1569 18GR	K1/A2	N2J1/3	
46	UL1569 18GR	K1/14	J8/7	
47	UL1569 18GR	J8/11	X1/E-4	
48	UL1569 18GR	J8/8	X1/55-4	
49	UL1569 18GR	N2J1/2	X1/54-4	
50	UL1569 18GR	N2J1/1	X1/53-4	
51	UL1569 18GR	N2J10/1	X1/42-4	
52	UL1569 18GR	N2J10/2	X1/43-4	
53	UL1569 18GR	J8/10	X1/35-4	
54	UL1569 18GR	C2 J1A/1	trig contr J2/7	
117	UL1569 18GR	trig contr J2/8	X1/12-4	
55	UL1569 18GR	C2 J1A/2	X1/37-4	
56	UL1569 18GR	D13/K	X1/31-4	
139	UL1569 18GR	D13/A	C2 J1A/3	
57	UL1569 18GR	C2 J1A/4	X1/A-4	
58	UL1569 18GR	C2 J1A/4	C2 J1B/9	
59	UL1569 18GR	D14/K	X1/39-4	
140	UL1569 18GR	D14/A	C2 J1A/5	
60	UL1569 18GR	C2 J1A/6	X1/14-4	
61	UL1569 18GR	C2 J1A/7	X1/40-4	
62	UL1569 18GR	C2 J1A/8	X1/27-4	
63	UL1569 18GR	C2 J1A/9	X1/18-4	
64	UL1569 18GR	C2 J1A/10	X1/17-4	
65	UL1569 18GR	C2 J1A/11	X1/29-4	
66	UL1569 18GR	C2 J1A/12	X1/15-4	
67	UL1569 18GR	C2 J1B/1	X1/26-4	
68	UL1569 18GR	C2 J1B/3	X1/33-4	
69	UL1569 18GR	C2 J1B/4	X1/23-4	
70	UL1569 18GR	C2 J1B/5	trig contr J2/5	
118	UL1569 18GR	trig contr J2/6	X1/9-4	
71	UL1569 18GR	C2 J1B/6	X1/19-4	
72	UL1569 18GR	D15/K	X1/21B-4	
141	UL1569 18GR	D15/A	C2 J1B/7	
73	UL1569 18GR	D16/K	X1/22-4	

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Type	Position 1	Position 2	Label (External Harness)
142	UL1569 18GR	D16/A	C2 J1B/10	
74	UL1569 18GR	C2 J1B/11	X1/25-4	
75	UL1569 18GR	C2 J1B/12	X1/6B-4	
76	UL1569 18GR	X1 FUSE/B	X1/2-4	
77	UL1569 18GR	X1 FUSE/T	X1/3-4	
78	UL1569 18GR	J8/1	X1/3-3	
79	UL1569 18GR	J8/9	X1/34B-4	
80	UL1569 18GR	J8/2	X1/26-2	
81	UL1569 18GR	J8/6	X1/39-3	
82	UL1569 18GR	J8/3	X1/40-2	
83	UL1569 18GR	J8/4	X1/41A-3	
128	UL1569 18ZW	S1 oscillating/12	S2 oscillating/11	
124	UL1569 18ZW	1		
125	UL1569 18ZW	2		
114	UL1569 18ZW	A/2	B/2	
115	UL1569 18GR	trig contr J2/3	D19/A	
138	UL1569 18GR	C2 J2B/1	D19/A	
130	UL1569 18GR	KTC/24	C2 J2B/8	
131	UL1569 18GR	X1/31-1	D17/A	
137	UL1569 18GR	K TC/11	D17/K	
132	UL1569 18GR	KTC/A2	X1/I-4	
133	UL1569 18GR	KTC/A1	trig contr J2/3	
143	UL1569 18GR	KL/24	C2 LED/GROEN	
144	UL1569 18GR	X1/D-3	KL/A2	
145	UL1569 18GR	X1/38-1	KL/11	
146	UL1569 18GR	D24/K	KL/A1	
147	UL1569 18GR	D25/K	KL/A1	
84	LIYYJZ5X0,5 UL			OUTRIGGER 4 SWITCH
	ader 1	X1/46-1		
	ader 2	X1/47-1		
	ader 3	X1/50-1		
	ader 4	X1/51-1		
	GGN			
85	LIYYJZ5X0,5 UL			OUTRIGGER 3 SWITCH
	ader 1	X1/45-1		
	ader 2	X1/46-2		
	ader 3	X1/49-1		
	ader 4	X1/50-2		
	GGN			
86	LIYYJZ5X0,5 UL			OUTRIGGER 2 SWITCH
	ader 1	X1/44-1		
	ader 2	X1/45-2		

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Type	Position 1	Position 2	Label (External Harness)
	ader 3	X1/48-1		
	ader 4	X1/49-2		
	GGN			
87	LIYYJZ5X0,5 UL			OUTRIGGER 1 SWITCH
	ader 1	X1/39-1		
	ader 2	X1/44-2		
	ader 3	X1/43-2		
	ader 4	X1/48-2		
	GGN			
88	LIYYJZ2X1 UL			DOWN SWITCH
	ader 1	X1/32A-2		
	ader 2	X1/55-1		
89	LIYYJZ2X1 UL			OSCILLATING AXLE
	ader 1	X1/36-2	Splice6/L	
	ader 2	X1/35-1	Splice7/L	
91	LIYYJZ2X1 UL			PUMP 1 VALVE
	ader 1	X1/11-1	1	
	ader 2	X1/G-1	2	
92	LIYYJZ2X1 UL			PUMP 2
	ader 1	X1/11-2	1	
	ader 2	X1/H-1	2	
93	LIYYJZ4X0,75 UL			TILT SWITCH
	ader 1	X1/28-1		
	ader 2	X1/29-1		
	ader 3	X1/B-2		
	GGN			
94	LIYYJZ4X0,75 UL			DRIVE 2 VALVE
	ader 1	KD2/12	1	
	ader 2	KD2/22	2	
	ader 3	X1/F-3	PE	
	GGN			
95	LIYYJZ2X1 UL			PRESSURE NIVO SWITCH
	ader 1	X1/53-1	1	
	ader 2	X1/54-1	2	
96	LIYYJZ2X1 UL			HORN
	ader 1	X1/25-1		
	ader 2	X1/G-2		
119	LIYYJZ2X1 UL			S 8M
	ader 1	X1/36-1		
	ader 2	X1/37-1		
97	LIYYJZ5X1 UL			MAX HEIGHT SWITCH
	ader 1	X1/36-1		

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Type	Position 1	Position 2	Label (External Harness)
	ader 2	X1/37-1		
	ader 3	X1/30-1		
	ader 4	D24/A		
	GGN			
98	LIYYJZ2X1 UL			LOWERING VALVE
	ader 1	X1/32-1B	Splice2/L	
	ader 2	X1/A-2	Splice3/L	
112	LIYYJZ2X1 UL			
	ader 1	1	Splice2/R	
	ader 2	2	Splice3/R	
113	LIYYJZ2X1 UL			
	ader 1	1	Splice2/R	
	ader 2	2	Splice3/R	
99	LIYYJZ2X1 UL			SER/PAR
	ader 1	X1/16-1	1	
	ader 2	X1/F-1	2	
111	LIYYJZ2X1 UL			DIFF LOCK VALVE 1
	ader 1	X1/20-2	1	
	ader 2	X1/C-2	2	
100	LIYYJZ2X1 UL			DIFF LOCK VALVE 2
	ader 1	X1/20-1	1	
	ader 2	X1/D-2	2	
101	LIYYJZ2X1 UL			BRAKE VALVE
	ader 1	X1/13A-1	1	
	ader 2	X1/E-1	2	
102	LIYYJZ2X1 UL			MAX HEIGHT SWITCH
	ader 1	X1/34A-1		
	ader 2	X1/27-1		
103	LIYYJZ7X1 UL			ENGINE BOX
	ader 1	X1/8-1		
	ader 2	X1/9-1		
	ader 3	X1/41A-1		
	ader 4	X1/58-3		
	ader 5	X1/I-1		
	ader 6			
	GGN			
104	LIYYJZ5X1 UL			2,5m SWITCH
	ader 1	X1/34A-2		
	ader 2	X1/26-1		
	ader 3	X1/35-2		
	ader 4	X1/36-3		
	GGN			

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Type	Position 1	Position 2	Label (External Harness)
105	LIYYJZ4X1 UL			PLATFORM VALVE
	ader 1	X1/22-1	1	
	ader 2	X1/21B-1	2	
	ader 3	X1/H-2	PE	
	GGN			
106	LIYYJZ4X1 UL			LIFT VALVE
	ader 1	KL/14	1	
	ader 2	X1/32B-3	2	
	ader 3	X1/B-1	PE	
	GGN			
107	LIYYJZ4X1 UL			DRIVE VALVE
	ader 1	X1/13B-1	1	
	ader 2	X1/14-1	2	
	ader 3	X1/D-1	PE	
	GGN			
108	LIYYJZ4X1 UL			STEERING VALVE
	ader 1	X1/18-1	A/1	
	ader 2	X1/17-1	B/1	
	ader 3	X1/C-1	A/2	
	GGN			
109	LIYYJZ12X0,75UL			OUTRIGGER VALVES
	ader 1	J7/1	1	OUTRIGGER 1 VALVE
	ader 2	J7/2	2	
	ader 3	J7/3	PE	
	ader 4	J7/4	1	OUTRIGGER 2 VALVE
	ader 5	J7/5	2	
	ader 6	J7/6	PE	
	ader 7	J7/7	1	OUTRIGGER 3 VALVE
	ader 8	J7/8	2	
	ader 9	J7/9	PE	
	ader 10	J7/10	1	OUTRIGGER 4 VALVE
	ader 11	J7/11	2	
	GGN	J7/12	PE	
126	LIYYJZ25X0,75UL			GROUND PANEL
	ader 1	X1/1-1	PA	
	ader 2	X1/2-1	PB	
	ader 3	X1/3-1	PC	
	ader 4	X1/4-2	PD	
	ader 5	X1/5-2	PE	
	ader 6	X1/6A-2	PF	
	ader 7	X1/7B-2	PG	
	ader 8	X1/9-2	PH	

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Type	Position 1	Position 2	Label (External Harness)
	ader 9	X1/21B-2	PJ	
	ader 10	X1/22-2	PK	
	ader 11	X1/56-2	PL	
	ader 12	X1/38-4	PM	
	ader 13	X1/41B-1	PN	
	ader 14	X1/32A-1	PO	
	ader 15	X1/30-2	PP	
	ader 16	X1/42-1	PQ	
	ader 17	X1/43-1	PR	
	ader 18	X1/58-2	PS	
	ader 19		PT	
	ader 20	D25/A	PU	
	ader 21	X1/B34-1	PV	
	ader 22		PW	
	ader 23		PX	
	ader 24			
	GGN			
110	LIYYJZ25X1 UL			SCISSORS CABLE SOCKET
	ader 1	X2/1	C2 J2A/1	
	ader 2	X2/2	C2 J2A/2	
	ader 3	X2/3	C2 J2A/3	
	ader 4	X2/4	C2 J2A/4	
	ader 5	X2/5	C2 J2A/5	
	ader 6	X2/6	NC	
	ader 7	X2/7	NC	
	ader 8	X2/8	C2 J2A/8	
	ader 9	X2/9	trig contr J2/2	
	ader 10	X2/10	C2 J2B/2	
	ader 11	X2/11	NC	
	ader 12	X2/12	C2 J2B/4	
	ader 13	X2/13	C2 J2B/5	
	ader 14	X2/14	C2 J2B/6	
	ader 15	X2/15	C2 J2B/7	
	ader 16	X2/16	KTC/21	
	ader 17	X2/17	X1/59-1	
	ader 18	X2/18	C2 LED/GEEL	
	ader 19	X2/19	KL/21	
	ader 20	X2/20	C2 LED/BLAUW	
	ader 21	X2/21	NC	
	ader 22	X2/22	C2 LED/ZWART	
	ader 23	X2/23	X1/58-1	
	ader 24	X2/24	NC	

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Type	Position 1	Position 2	Label (External Harness)
	GGN	NC	NC	
121	LIYYJZ2X1 UL			S. OSCILLATING AXLE
	ader 1	PNP5 J2/3	Splice4/L	
	ader 2	X1/I-2	Splice5/L	
122	LIYYJZ2X1 UL			
	ader 1		Splice4/R	
	ader 2		Splice5/R	
123	LIYYJZ2X1 UL			
	ader 1		Splice4/R	
	ader 2		Splice5/R	
124	UL1569 18ZW	1		
125	UL1569 18ZW	2		
126	LIYYJZ25X0.75 UL			GROUND PANEL
	ader 1	X1/1-1	PA	
	ader 2	X1/2-1	PB	
	ader 3	X1/3-1	PC	
	ader 4	X1/4-2	PD	
	ader 5	X1/5-2	PE	
	ader 6	X1/6A-2	PF	
	ader 7	X1/7A-2	PG	
	ader 8	X1/9-3	PH	
	ader 9	X1/21B-2	PJ	
	ader 10	X1/22-2	PK	
	ader 11	X1/56-2	PL	
	ader 12	X1/38-4	PM	
	ader 13	X1/41A-4	PN	
	ader 14	X1/32A-1	PO	
	ader 15	X1/30-2	PP	
	ader 16	X1/42-1	PQ	
	ader 17	X1/43-1	PR	
	ader 18	X1/58-2	PS	
	ader 19	X1/A-1	PS	
	ader 20	D25/A	PT	
	ader 21	X1/34B-1	PU	
	ader 22		PV	
	ader 23		PW	
	ader 24		PX	
	GGN			
128	LIYYJZ2X1 UL			
	ader 1	Splice6/R	S1/11	
	ader 2	Splice8/R	S1/12	
129	UL 1569 18R	K VS/Y1	K VS/Y2	

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Type	Position 1	Position 2	Label (External Harness)
130	UL 1569 18GR	KTC/24	C2 J2B/8	
131	UL 1569 18GR	X1/31-1	D17/A	
132	UL 1569 18R	DIODE 6/K	X1/60-2	
132	UL 1569 18GR	KTC/A2	X1/1-4	
133	UL 1569 18BR	DIODE6/A	X1/38-2	
133	UL 1569 18GR	KTC/A1	TRIG CONTR J2/3	
134	UL 1569 18GR	X1/60-3	BUZ/1	
135	UL 1569 18GR	TRIG CONTR J2/4	K TC/14	
136	UL 1569 18GR	K TC/11	D20/K	
137	UL 1569 18GR	K TC/11	D17/K	
138	UL 1569 18GR	C2 J2B/1	D19/A	
139	UL 1569 18GR	D13/A	C2 J1A/3	
140	UL 1569 18GR	D14/A	C2 J1A/5	
141	UL 1569 18GR	D15/A	C2 J1B/7	
142	UL 1569 18GR	D16/A	C2 J1B/10	
143	UL 1569 18GR	KL/24	C2 LED/GROEN	
144	UL 1569 18GR	X1/D-3	KL/A2	
145	UL 1569 18GR	X1/38-1	KL/11	
146	UL 1569 18GR	D24/K	KL/A1	
147	UL 1569 18GR	D25/K	KL/A1	
148	LIYY JZ2X1			
	ader 1	Splice8/L	S2/11	
	ader 2	Splice7/R	S2/12	
D1	DIO BY550	X1/7A-3	X1/8-3	
D2	398 ANSI DIO	X1/8-4	X1/33-3	
D3	398 ANSI DIO	X1/11-4	X1/41A-4	
D4	398 ANSI DIO	X1/11-4	X1/40-3	
D5	398 ANSI DIO	X1/25-3	X1/B-3	
D6	398 ANSI DIO	X1/32B-4	X1/B-4	
D7	398 ANSI DIO	X1/41B-2	X1/21B-2	
D8	398 ANSI DIO	X1/20-3	X1/C-3	
D9	398 ANSI DIO	K VS/A1	K VS/A2	
D10	398 ANSI DIO	REL/12	REL/21	
D11	398 ANSI DIO	X41/A-2	X1/22-3	
D12	398 ANSI DIO	KD2/A1	KD2/A2	
D18	DIO BY550	K TC/A2	K TC/A1	
D21	398 ANSI DIO	X1/51-3	X1/30-3	
D22	398 ANSI DIO	X1/56-2	X1/30-2	
D23	DIO BY550	KL/A2	KL/A1	
S1	CSS 1001 (2x)			
S2	CSS 1001 (4x)			
S3	CSS 1009			

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Type	Position 1	Position 2	Label (External Harness)
S4	CSS 1009			
S5	CSS 1003 (7x)			
S6	CSS 1003			
S7	CSS 1002			
S8	CSS 1003 (2x)			
S9	CSS 1005			
S10	CSS 1007			

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NOTE: ***Position 1*** *= Termination point in the Main Terminal Box (There are 4 connections at each terminal position on X1. These are designated as 1 = Top Top, 2 = Tob Bottom, 3 = Bottom Top, and 4 = Bottom Bottom. Refer to Figure 5-1., Main Terminal Box)*

Position 2 *= The position on the end item (if not specified in the table, it can be located on the electrical schematic).*

NOTES:

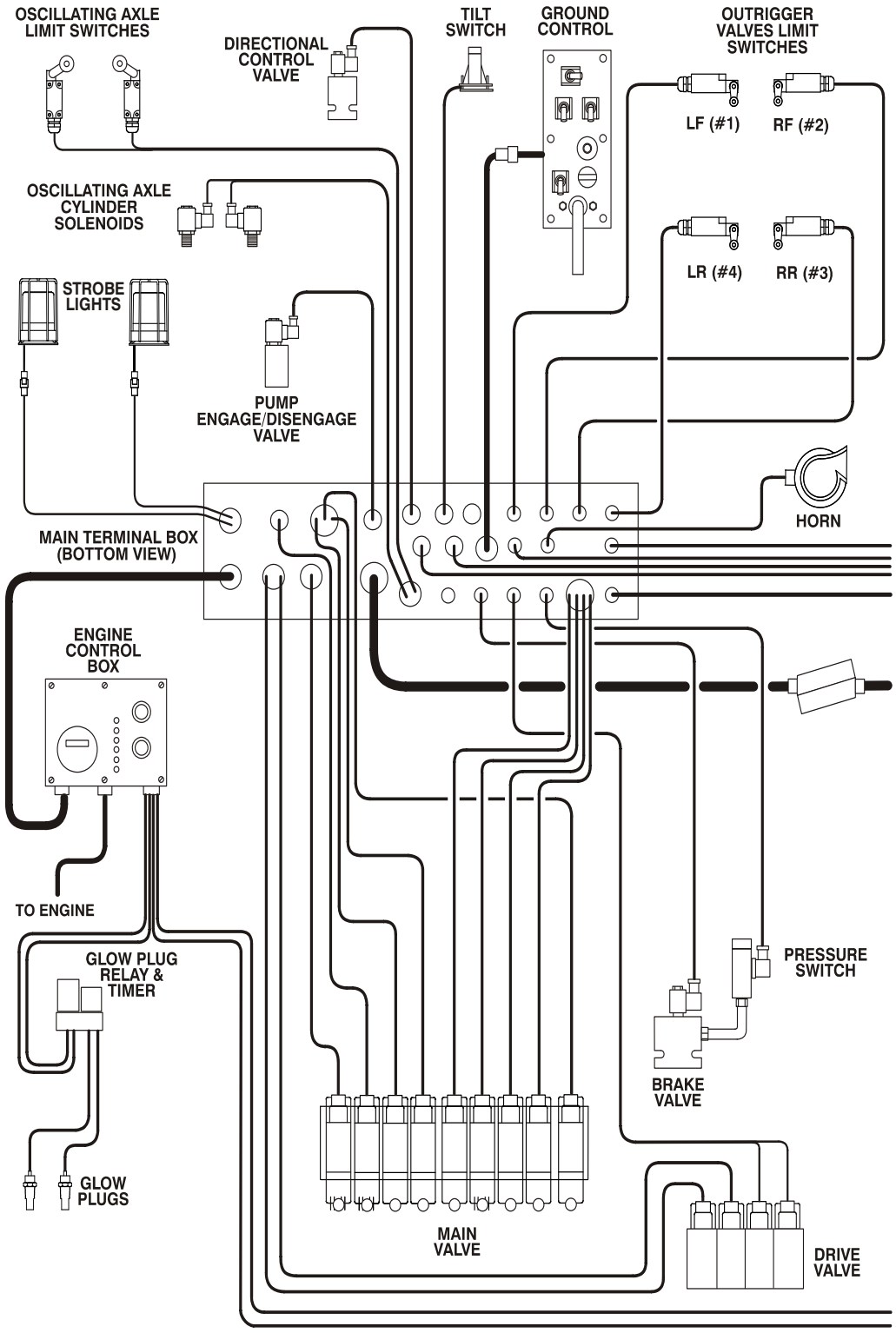

Figure 6-33. Electrical Diagram - Page 1 of 2

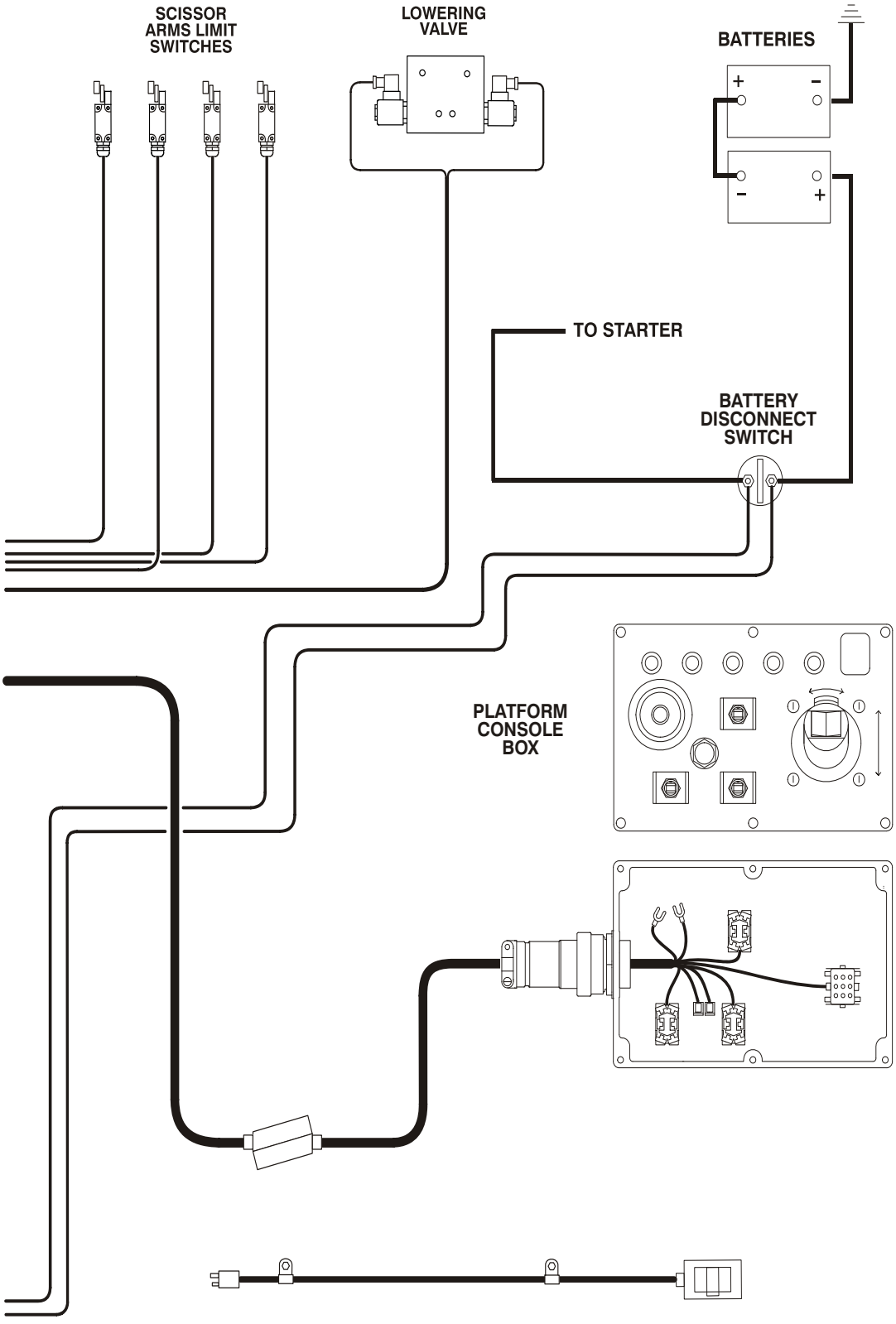

Figure 6-34.

Electrical Diagram - Page 2 of 2

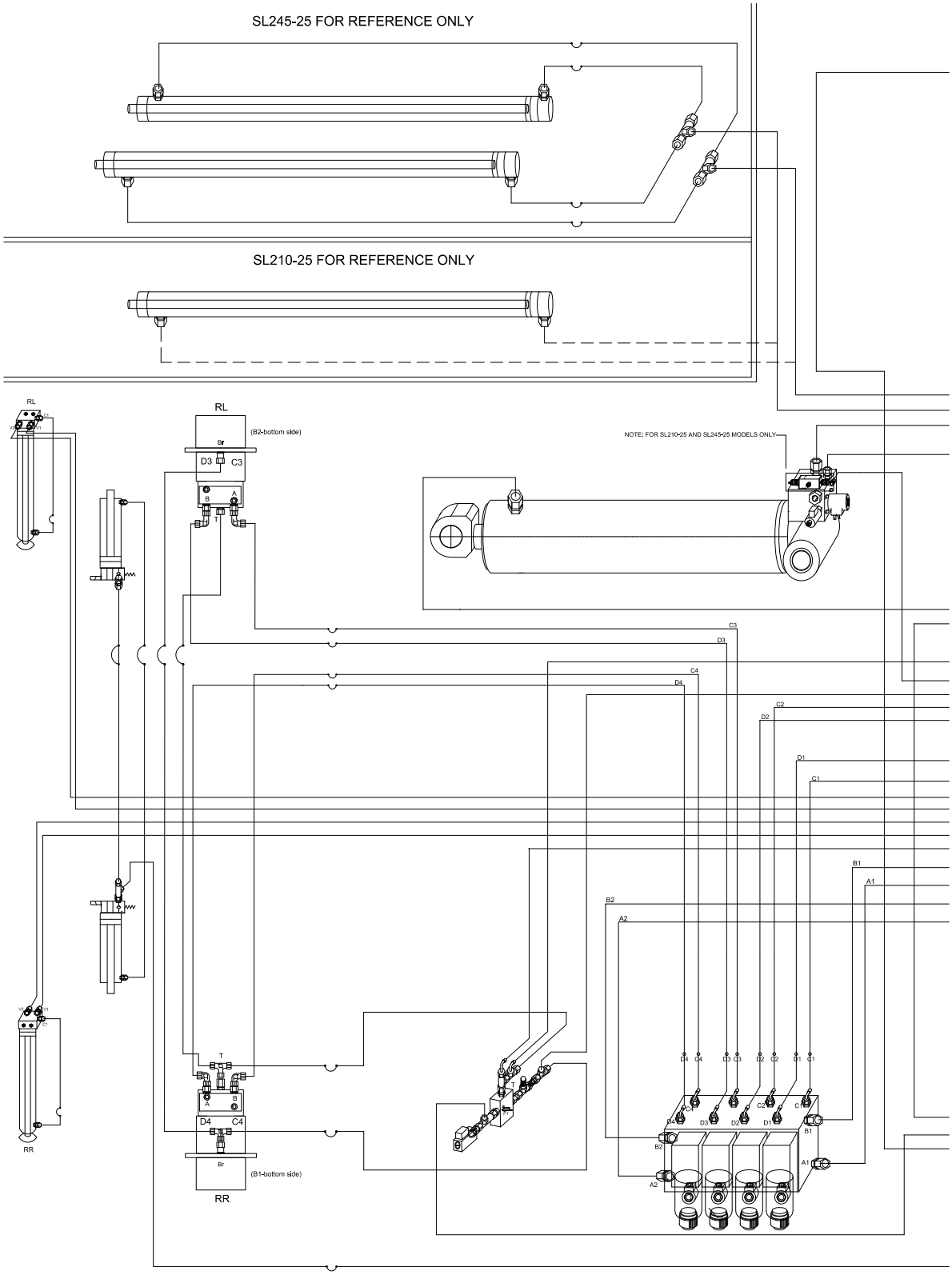

Figure 6-35. Hydraulic Components - H900067 RevF - Page 1 of 2

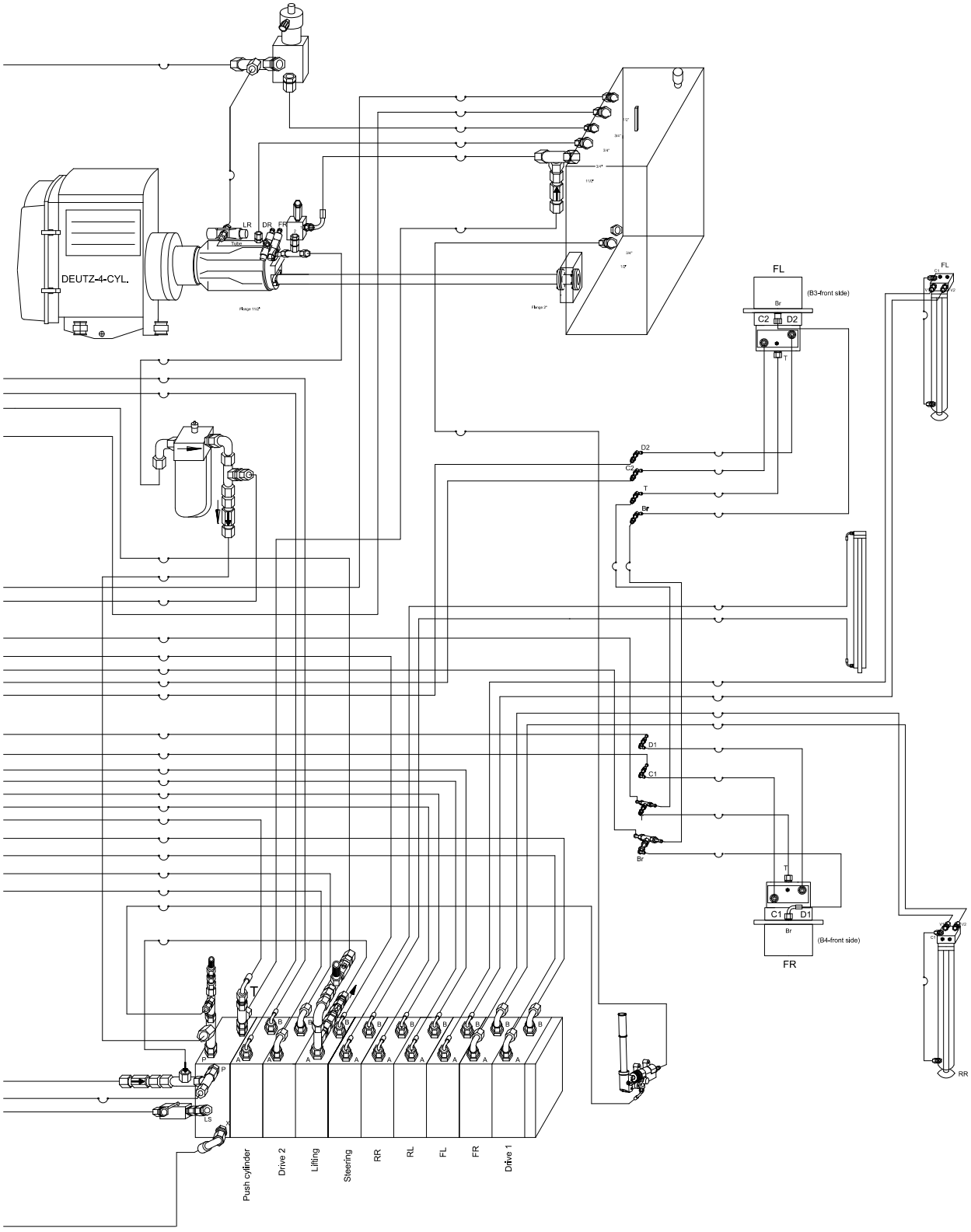

Figure 6-36. Hydraulic Components - H900067 RevF - Sheet 2 of 2

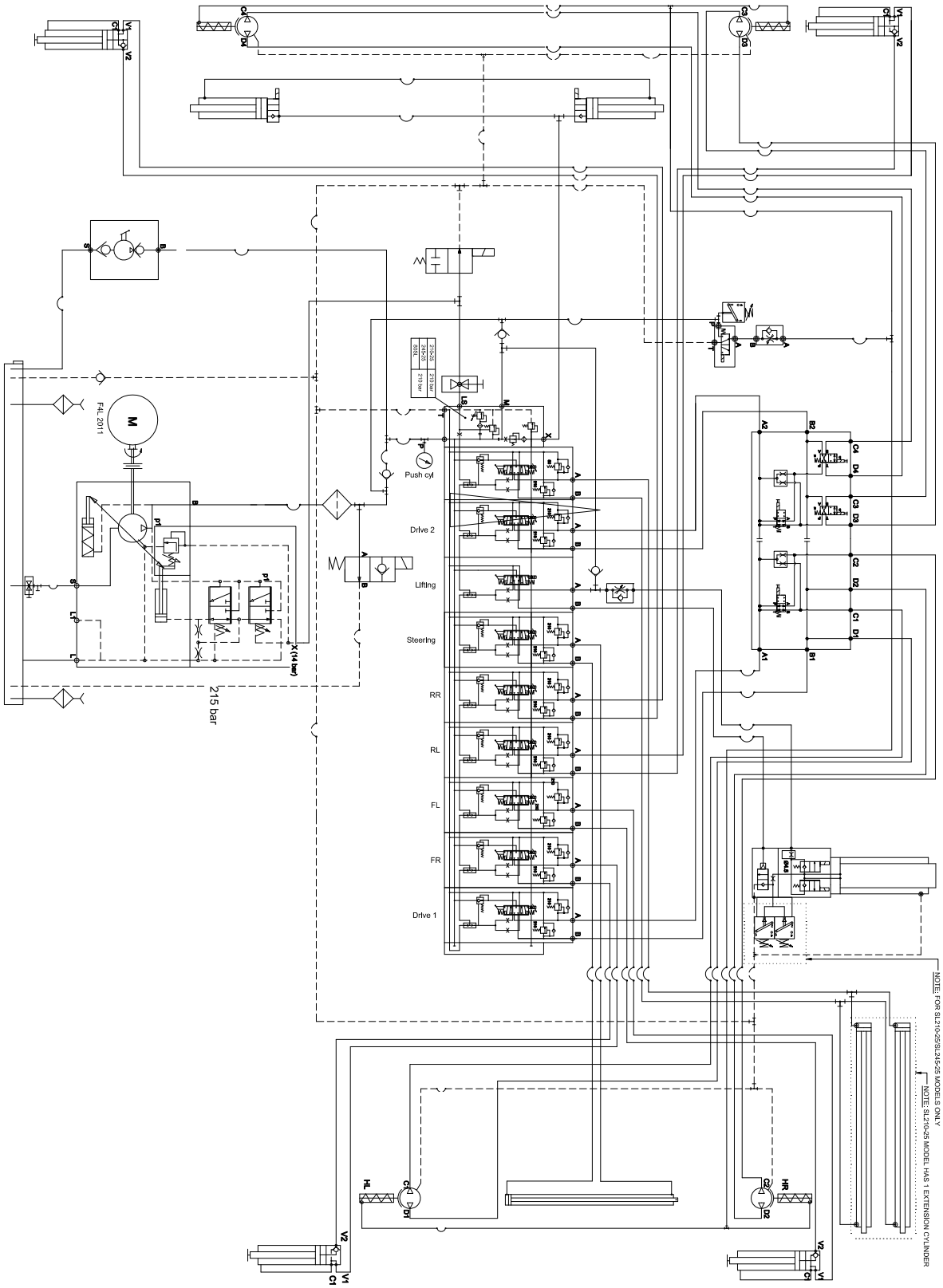

Figure 6-37. Hydraulic Schematic - 1001091321 RevD

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